AUGUST 21, 1961

American Machinist / Metalworking Manufacturing

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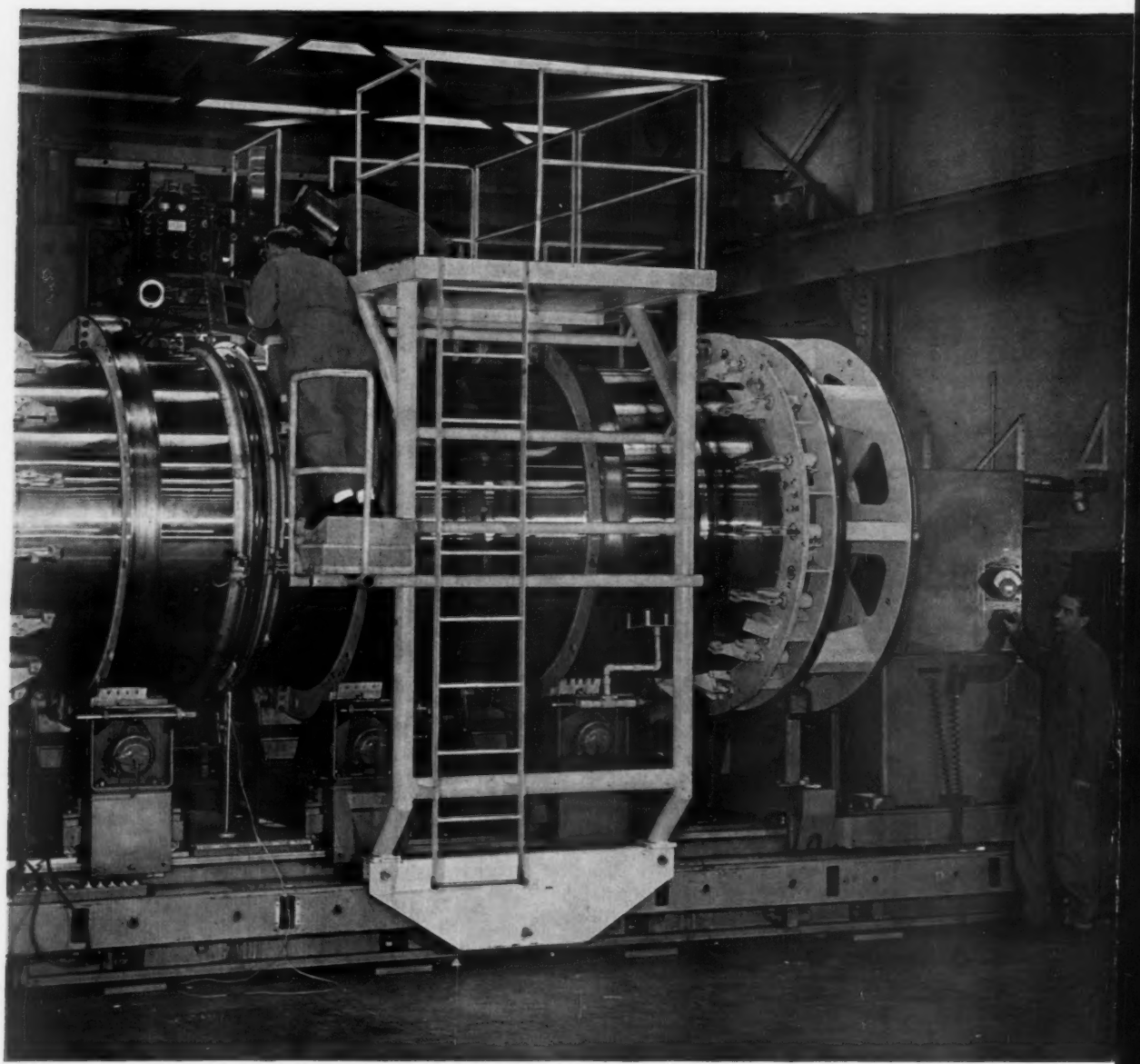

Welding fixture aligns and clamps Minuteman ICBM rocket-case sections, page 95

- **Heat treating teams with brazing,** p101
- **Forming to ±0.005 in. on a press brake,** p106
- **Transfer line for a long run,** p114

EFFECTIVE COOLING...

How to Avoid Barrel-Shape Bores

by Dr. Robert Hahn
Chief Research Engineer
The Heald Machine Company

One of the oldest problems in high-precision internal plunge grinding is that of the unwanted barrel-shaped hole. For some time the cause of this seemingly unavoidable defect was not well understood. How could a perfectly straight wheel, perfectly aligned with the bore, plunge grind a barrel-shape hole?

Recent investigations in this area, as part of our continuing quality improvement program, have isolated the cause and pointed the way to some fairly simple solutions to the problem.

The culprit is *heat*. At the area of contact between work and wheel, the generated heat is more quickly dissipated at the ends of the bore than at the center. This temperature relationship is shown in Fig. 1, with surface temperatures reaching maximum value at the center of the bore. Maximum temperature means maximum thermal expansion—expansion that forces more metal into the wheel at the center of the bore than at the ends. With this unequal stock removal, the bore assumes a barrel shape on cooling. These relationships hold true for plunge grinding, and also, but to a lesser extent, for some cases in traverse grinding where limiting factors require a short stroke.

To reduce the barrel shape, it is necessary to level out the temperature curve—by reducing the amount of heat generated and by providing more effective cooling.

The contact area between wheel and work can be considered as a moving heat source that travels around the bore at a rate equal to the workhead speed. The faster this heat source travels, the less the heat will penetrate into the metal. Hence higher work speeds will reduce local heating. And since the heat generated is a function of contact pressure and surface feet per minute, lighter feeds and slower wheel speeds in such cases also help to reduce the thermal distortion.

Water-base coolants, copiously applied, have also proved an effective remedy. As shown in Fig. 2, the coolant flow should maintain a full "reservoir" at the bottom of the bore, as well as between the wheel and work. The coolant flow at the bottom of the bore quenches the metal immediately after the ground surface passes the wheel and assures maximum cooling effect before this point again contacts the wheel.

In practically all cases, a judicious combination of these factors—faster work speeds, slower wheel speed, lighter feeding pressure and improved cooling—will reduce the barrel-shape of a bore to negligible values. This study is typical of the continuing research being conducted at Heald to help refine the art of modern metalworking. Your nearest Heald representative will be glad to help you solve your particular grinding or boring problems.

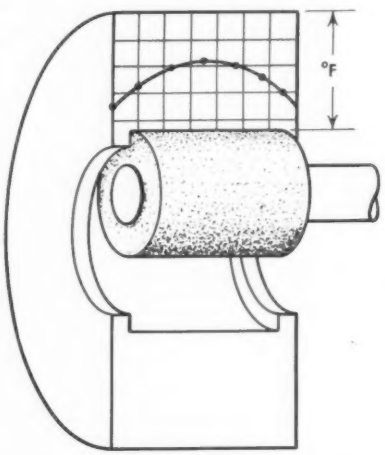

FIG. 1. Section through plunge-ground bore, showing unequal temperature rise in the metal which results in barrel-shape bore on cooling.

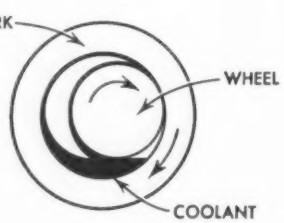

FIG. 2. End view of wheel and work, showing coolant flow for most effective dissipation of heat.

It PAYS to come to Heald

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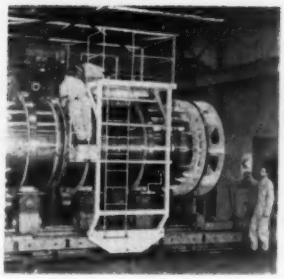
COVER:

Rocket engine cases for Minuteman ICBM are progressively aligned, clamped and welded in special Lewis welding fixture at Allison Division of General Motors. See p95.



American Machinist / *Metalworking Manufacturing*

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Metalworking machinery orders to rise 11% . . . Forecast calls for 11% rise by second quarter of 1962. Machinery, in general, to rise 7% **105**

Forming to ±0.005 in. on a press brake . . . A special pin gage plus strict attention to possible sources of error permits close tolerance forming. *By Roland J Casey, General Electric Co* **106**

Which pressure angle is best? . . . Here are some tips on how to choose between 14½° and 20° pressure-angle gearing. *By Frank J Rankar, Ohio Gear Co* **108**

Meet Mr. Sigma . . . Confused by statistical quality control? No need to be. Mr. Sigma can tell you all you need to know and how to do it with simple arithmetic. *By W F Conroy, General Electric Co* **109**

Jig boring on small turret lathes . . . Transfer jig plates adapt small turret lathes to precision boring. *By John Dow and Clarence Mathewson, Minneapolis-Honeywell Regulator Co* **113**

Transfer line for a long run . . . A small but fully mechanized line has tripled output of automatic washer agitator shafts at Whirlpool Corp. *By Charles Emerson* **114**

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TURN PAGE FOR METALWORKING REPORT ——►

METALWORKING REPORT

. . . what's new and significant in manufacturing techniques and materials—

direct from our own staff and round-the-world news bureaus

MATERIALS . . . Miniaturized reinforced metals, built up much like structural concrete, are finding more and more applications in metallurgy. After increasing the high-temperature strength of copper (*AM*—Jan 26 '59, p87), General Electric research now finds that **reinforcing silver with tiny "whiskers" of alumina (sapphire) increases its strength fivefold.** Similar techniques applied to high-strength metals are expected to produce metals several times stronger (at white heat) than any high-strength alloy.

MANUFACTURING CONTROL . . . A new symbolic code cuts computer programming in half. That is the claim of Minneapolis-Honeywell, which developed the code for its No. 800 computer. Called Argus (for Automatic Routine Generating and Updating System), **the simplified code puts the burden of programming details on the computer.** Another time-saving feature: With the code, the programmer has speedy access to a library of routines (developed by M-H) that can be incorporated into any computer program.

FORMING . . . Sheet metal parts can be formed to ±0.005 in. on a press brake. The article beginning on page 106 analyzes the sources of error in forming, and tells how to avoid or minimize them to permit holding such close tolerances on a press brake.

WELDING . . . A new power supply unit lets an operator do two jobs at the same time: While he is welding one joint, he can also stress-relieve as many as 12 previous welds with automatically-controlled resistance-heating units. Developed by Electric Arc, Inc (Newark, NJ), and called the Unipak, **the machine has six resistance-heating controls,** and each of them can supply either two 100-amp heating elements or one 200-amp element. At the same time, **another part of the machine supplies constant-potential arc-welding current (either ac or dc)** at 300 amps. Unit operates from 220/440-v single-phase line.

MATERIALS . . . Continuous ceramic fibers, for building large, shell-like ceramic structures, may be one result of research in Pycerox by Narmco Industries, a subsidiary of Telecomputing Corp. Produced by cooling molten Pycerox, the crystalline fibers might be **filament wound on mandrels to produce shapes now machined from huge single crystals.** As a liquid-phase sintering agent, Pycerox **cut sintering temperature and time for beryllium oxide from 60 min at over 3000 F to 5 min at 2000 F.** Original method used 100% BeO; later method used 70 to 90% BeO and the remainder Pycerox.

INSPECTION . . . High-speed three-color pyrometer that can make 1000 individual temperature determinations per second over a range of 1000 to 3000 C has been developed by the National Bureau of Standards. It should prove valuable in measuring temperatures of missile parts during firing tests, of ablating nose-cone materials, and, with modifications, of exploding wires. Data is recorded with an oscilloscope, magnetic tape, or other high-speed recorder. **Temperature readings are accurate to about one percent.**

CUTTING . . . A coordinate setup system—called Minuteman—can reduce setup time to as little as three minutes on American Tool Works' line of numerically controlled lathes. The system, based upon the principle of interchangeable tool turrets (with pre-set tooling) and an adjustable limit switch stop, **establishes a constant zero-zero position for successive like pieces.** This also maintains position in case of power failure.

MATERIALS HANDLING . . . A mechanical keyboard, which travels right on the conveyor, automates many handling jobs. Called Select-O-Matic, the unit is about the size of a cigar box, has 13 pushbuttons for setting up such jobs as pickup, deliver, and return. **As it moves with the conveyor, the keyboard directs operations for conventional carriers that follow it.** The maker, Tele-Sonic Packaging Corp (New York City) reports that the keyboard can be adapted to already-installed conveyor lines.

FINISHING . . . Hot-melt, peelable plastic coatings can be sprayed on large surfaces (even machines) by a small, portable spray unit developed by Evens-Thompson Mfg Co, Inc (Center Line, Mich). Electrically heated spray gun will apply a ⅛-in. coat at 8 to 10 sq ft per min. Pumping unit is self-purging and **mounts on edge of melt tank, much like an outboard motor.** Unit requires only 115-v, 3-wire power and 60 to 80 psi air supply.

FORMING . . . Tungsten alloys have been forged into thin-section structural shapes by the Materials Technology Dept of Tapco (a division of Thompson Ramo Wooldridge) under an Air Force contract. Forgings incorporate hard-to-achieve **tolerances such as web and rib thicknesses of 0.130 ±0.015 in., suface finish of 30 microinches RMS, and draft angles as low as one degree.** Specially designed 700-ton press was used to extrude tungsten alloy ingots into bar stock, which was then heated in a vacuum furnace prior to three-step forging on a Maxipres forging press.

HEAT TREATING . . . High-strength, heat-resistant alloy parts that are heat treated and brazed in the same operation show fewer metallurgical defects and greater dimensional stability. Also (see p101), **handling costs and overall processing time are greatly reduced.**

MATERIALS HANDLING . . . 100 packets of small parts a minute are turned out by Electro-Pak, a new packaging machine that works with automatic vibratory counters. **Up to three different types of parts can be put in each heat-sealed packet.** While the machine is sealing the packets, it also prints on the poly-kraft paper any information specified by the customer. Called a "packaging service" by developer Abbott Screw & Mfg Co (Chicago), this automatic machine is said to **wrap up parts at 1/10 the cost of hand packing.**

Continued on next page

Coming in AM/MM

- *How to estimate dies, jigs, and fixtures*
- *Tube expanding with explosives*
- *Mist cooling with adjustable heads*

METALWORKING REPORT . . .

CUTTING . . . Errors are forecast, and machine tool is stopped before damage is done, by an N/C system developed by EMI in England for a Droop & Rein miller. A fault in data tape is predicted—before data goes into machine control— by **comparing the next information to be put in with the last supplied.** If path isn't smooth, machine is stopped. When a part has sudden changes in configurat'on, sampling system is shut off by tape signals which make the system inoperative during the change.

FINISHING . . . Peeling and flaking of paint on galvanized surfaces is prevented by an acid etch, called Galva Etch, according to Martin-Senour Co (Chicago). The material cleans and etches galvanized, cadmium-plated, and zinc-treated surfaces to give an excellent bond for paint; it **also improves paint durability.**

FORMING . . . Up to 50,000 parts having intricate shapes with both thin and heavy sections can be formed before regrinding, reports Kwikset Powdered Metal Products, (Anaheim, Calif). When producing small gear sections, internal splines, ratchet arms, and similar precision parts where thickness variation is great, the company had excessive tool breakage. When they adopted Carpenter RDS **nickel-chromium steel (AISI Type L6) as the punch material, breakage was no longer a problem** for powdered metal fabrications.

GEARING . . . A coil of tooth-shaped steel wire can cut worm gear costs in half. Ulrich Bros, Inc (Corpus Christi, Texas) coils cold-formed steel wire with an inside diameter a few thousandths smaller than the intended shaft. Thus, **fitting a gear-coil on a shaft spreads the coil slightly and clinches the gear tightly to the shaft** so that no other fastener is needed. Gears with copper-wash coatings come in any length for ⅛ to ½-in. shafts.

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EXECUTIVE, EDITORIAL, CIRCULATION, ADVERTISING and PUBLICITY OFFICES: McGraw-Hill Building, 330 West 42nd St., New York 36, N. Y. Telephone: LOngacre 4-3000. Teletype: TWX N. Y. 1-1636. Cable Address: McGRAWHILL, New York.

PRINTED IN GARDEN CITY, N. Y. Second-class postage paid at New York City and Garden City, N. Y. Title registered in U. S. Patent Office.

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The newest Cincinnati bed type . . . the POWERMATIC . . . fills the need for a fast, automatic medium-duty milling machine equipped to handle job shop quantities as well as high-volume work. They're built in two styles: Plain Automatic and Automatic Rise-and-Fall. These two styles give you a choice of automatic cycle compatible with modern tooling and methods. Here are the primary timesaving possibilities:

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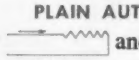
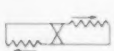
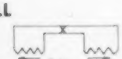
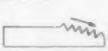
- One-way  and two-way  automatic table cycles.

AUTOMATIC RISE-AND-FALL

- One-way and two-way  automatic table cycles, synchronized with vertical traverse of spindle carrier, feeding down, rapid up and down.
- Profile milling  within 30° rise from the horizontal, one-way and two-way table cycles.
- Box milling feeding left and right, and up and down.

It's easy to coordinate these and other Powermatic feature-advantages with advanced manufacturing engineering in the field of intermediate range automatic milling. And to help you devise the most efficient tooling, Cincinnati offers the unmatched experience of their Engineering Service Department. Now turn the page and you'll see how one Powermatic was tooled up by Cincinnati to gain maximum benefit from the automatic *profile* milling cycle. **Milling Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

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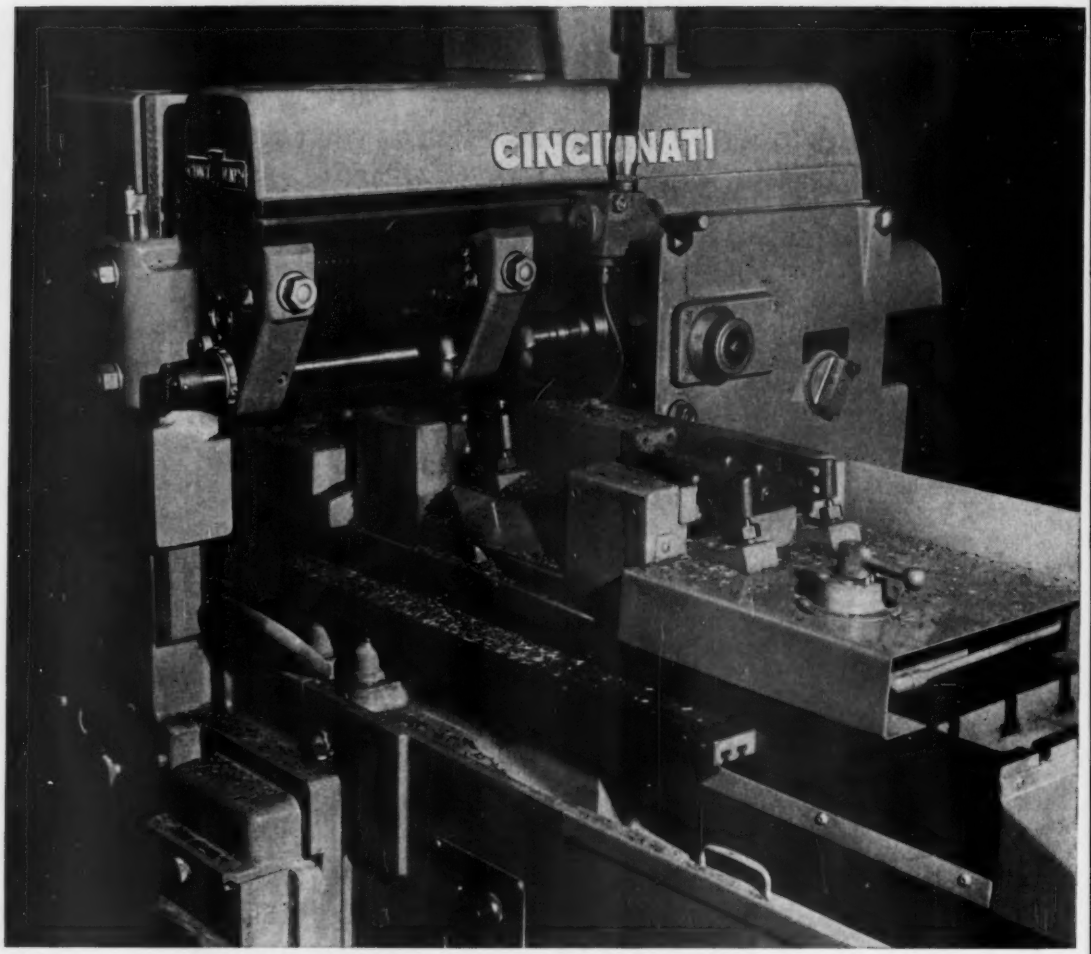

Shotgun frames are automatically profile milled, at a down-milling feed rate of 9-9/16 in./min., two abreast (four per cycle) on this new CINCINNATI Powermatic Rise-and-Fall Milling Machine.

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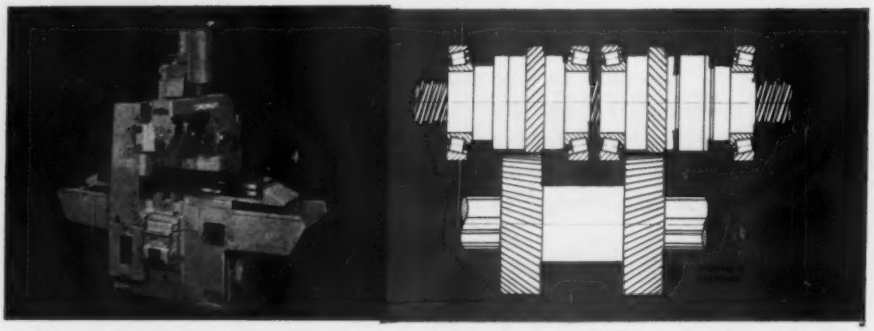

CINCINNATI Powermatic Rise-and-Fall Milling Machine. 24" or 30" table travel; 7½ hp spindle drive. Catalog No. M-2167.

Automatic compensation for wear between table feed screw and nut; a prime feature-advantage for reciprocal setups and "down" milling.

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FOUR in ONE

TIMESAVING POWERMATIC CYCLE...

Four Parts Profile Milled Two Abreast

New CINCINNATI Powermatics give automatic cycle milling a new dimension in cost reduction. The example at the left shows one of the many unique possibilities. In a single timesaving cycle, bottom profiles are milled on four shotgun frames. They are mounted two abreast, in a Cincinnati designed, hydraulically operated fixture. Smooth down-milling, an advantage derived from Powermatic's automatic backlash eliminator, produces a superior finish and prevents springing of the work.

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- *Single lever control* . . . starts the complete automatic cycle.
- *Effective chip and cutting fluid collecting system* . . . chip pans easily removed.
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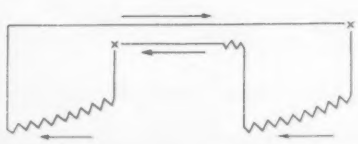
- *One integral casting for the front base and column* . . . assures maximum rigidity for full hp cuts.

Many additional feature-advantages give new CINCINNATI Powermatics the highest cost-reducing potential for medium-duty work, in high-volume and medium-volume shops. Get more information by asking for a copy of Catalog M-2167.

Program director . . . a simple cycle selector controls sequence of events in automatic cycle. Can be interchanged in a minute or less.



A two-segment automatic cycle, one of dozens available on the new CINCINNATI *Powermatic Rise-and-Fall Milling Machine, is employed to profile mill four parts, two abreast.*

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Solid construction features include: rugged hob head and double wall construction column and bed, with heavy V-ways. Table is as large as maximum workpiece diameter, and index worm gear nearly as large as work table. Work column is of massive design.

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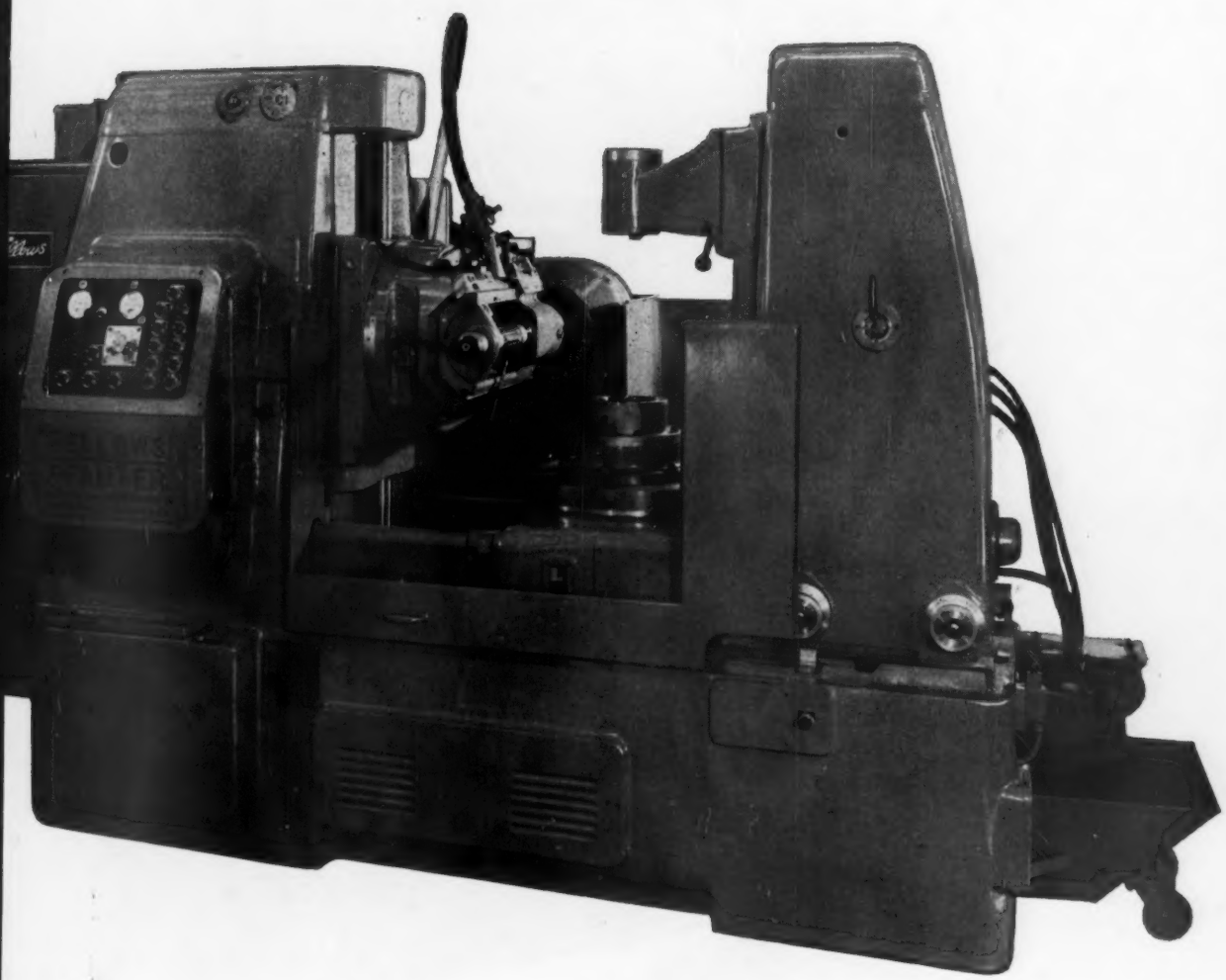
Eliminate tedious calculations and trial-and-error methods for finding change gear combinations. Now, simply look them up like words in a dictionary in "Fellows-Pfauter Change Gear Tables" by F. Bechei and A. Koerner. This English edition contains combinations for more than 26,000 ratios carried to six decimal places from .100,000 to 1.000,000, with the greatest step approximately .00005. Change gears in the range of 18 to 80 teeth are mainly used. Examples of applications are given. Only $8.00. Get a copy now. Send your order to THE FELLOWS GEAR SHAPER COMPANY, 78 River Street, Springfield, Vermont, U. S. A.



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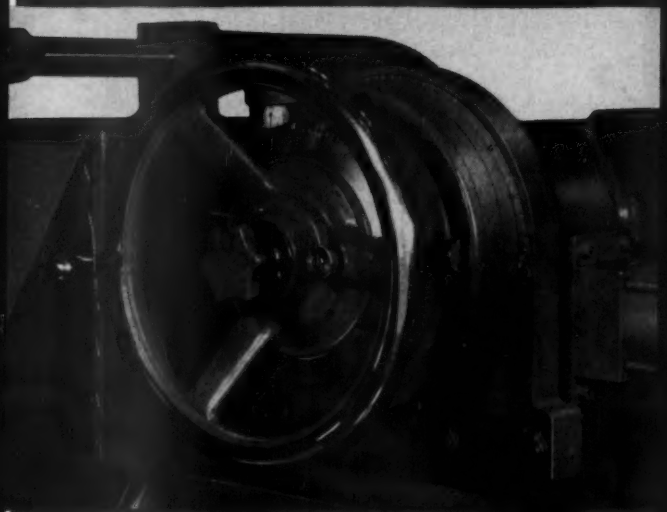
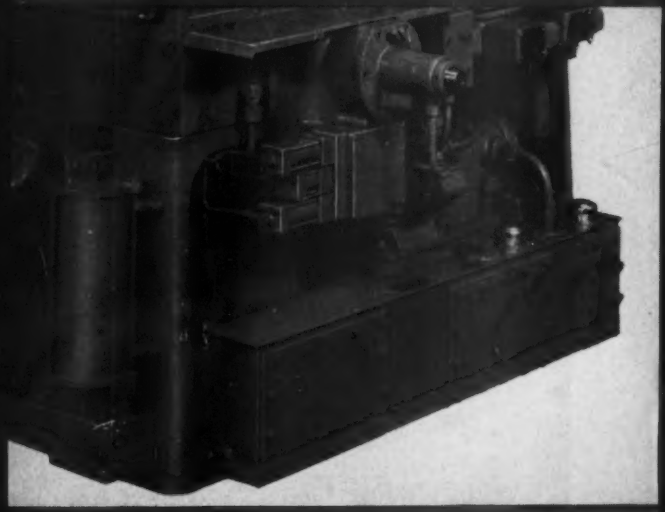
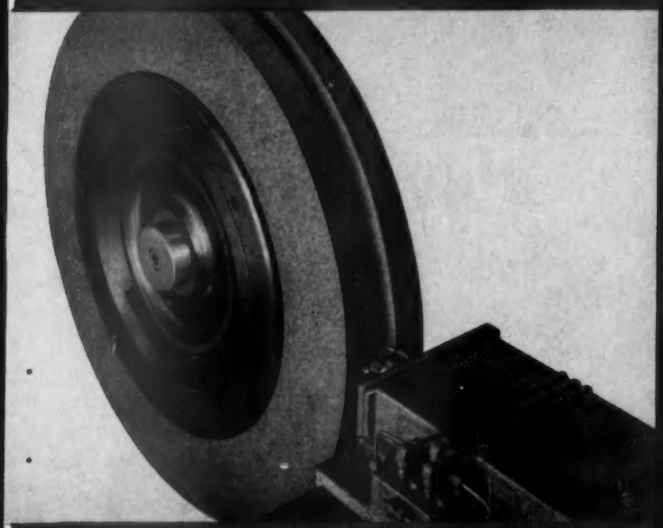


New eye level wheel feed with turning handwheel shows both rate and amount of feed on semiautomatic machines.

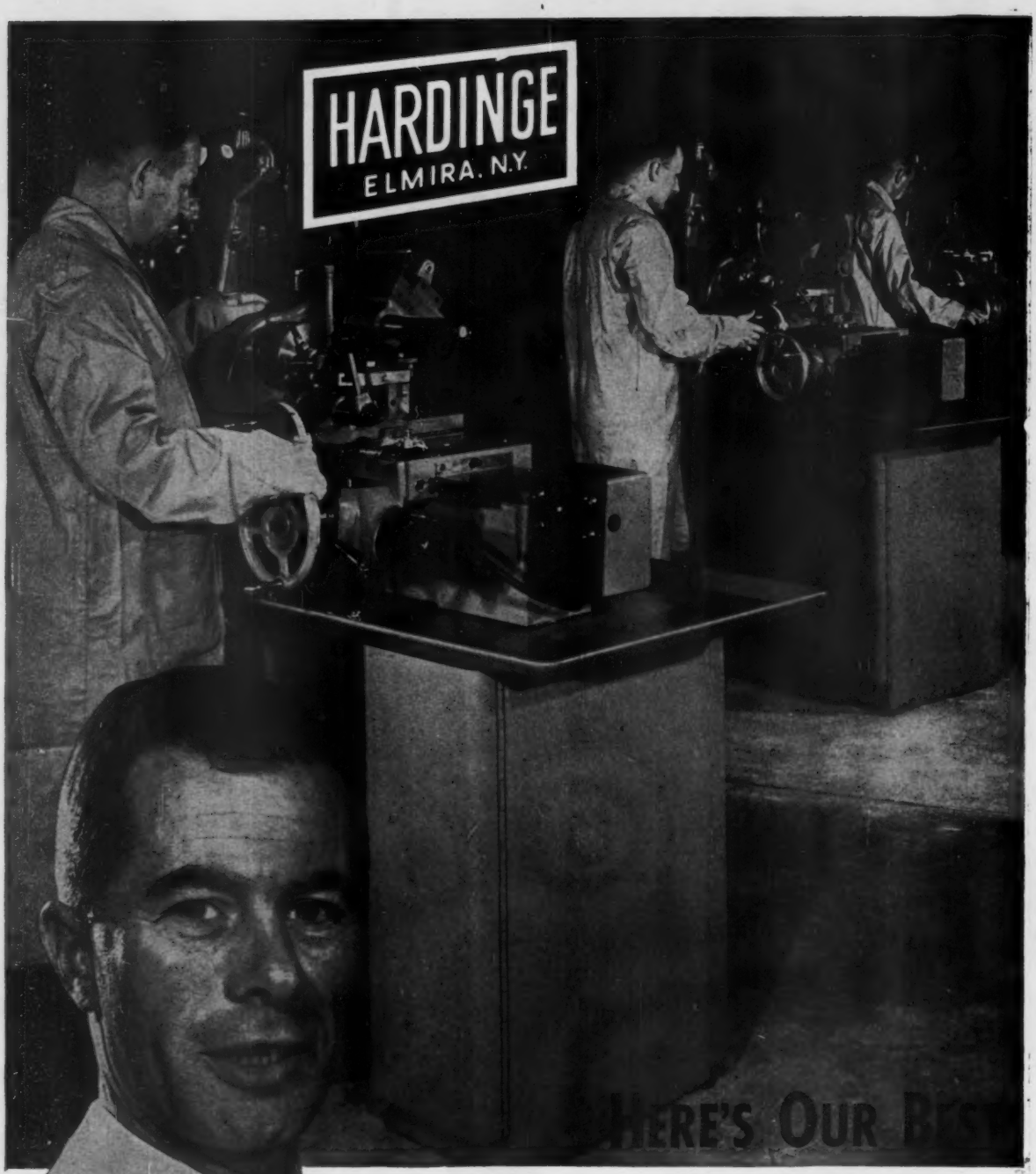


New isolated oil reservoir maintains machine alignment through better temperature control.



TRUFORM Wheel Dresser . . . preloaded ball slide design eliminates shake. Assures exact duplication of the profile on the wheel. Extra equipment.

Size Finder . . . a direct reading indicator used with Microfeed to reduce setup and grinding time in the grinding of multiple diameter shafts. Extra equipment.



INVESTMENT

HARDINGE machines for Super Precision and High Speed Production at low cost.

See the HARDINGE Sales Engineer for complete information and specifications.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

OFFICES IN PRINCIPAL CITIES. Export Office—269 Lafayette St., New York 12, N. Y.

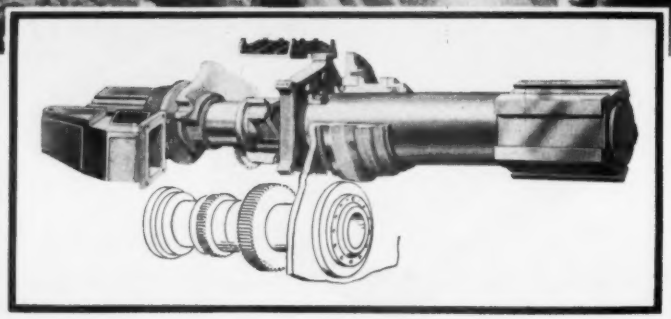
Landis 18" hydraulic face grinder powered for fast stock removal... heavy cuts—fine finishes

- fastest method of squaring up faces
- takes deep cuts—up to ¼" per pass on cast iron
- easy, faster setup
- simple operation
- saves time and costs

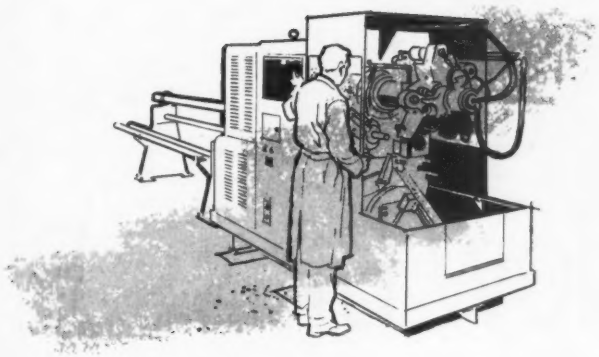
LANDIS

LANDIS TOOL COMPANY, WAYNESBORO, PA.

The secret of precision finishing on automatics lies strongly in customer "know-how". Good machine design also helps. For example, the massive 2AB Pentagon Turret is located overhead, away from accuracy-destroying grit, and coolant splash. For lasting accuracy, turret and spindle bearings are ruggedly built and housed within the same temperature zone to insure stability under operation.



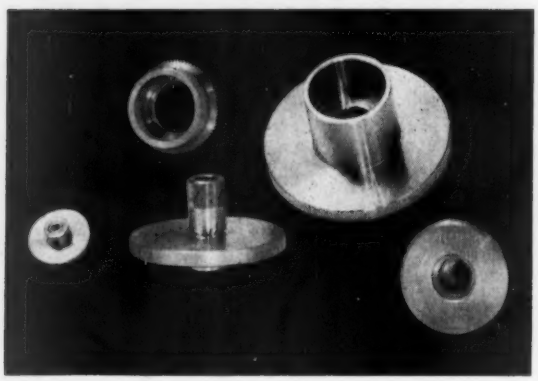
AT ARCH GEAR WORKS, INC.
Quincy, Mass.



3" Bar Automatic produces stainless gears with .0005" tolerances and 16 rms finishes

Contract shop stays highly competitive with elimination of extra finishing operations, low tool costs, 3 to 4-hour setups.

By using a Warner & Swasey 2AB Single Spindle Bar Automatic for small lot precision gear work, Arch Gear Works has eliminated secondary finishing operations.



75% of Arch Gear's precision parts are stainless steel. The 2AB produces jobs like these 3 times faster than turret lathes, and eliminates the extra finishing operations as a bonus.

Tooling costs are at rock-bottom, with the 2AB utilizing simple cutter bits in its multiple-position tool stations. The cost of cams is eliminated by controlling feeds, speeds, turret strokes and other motions with easy-to-set trip dogs.

Since they can set up their 2AB in 3 to 4 hours, Arch Gear Works is automating lots as low as 150 pieces—jobs formerly considered profitable only on hand-operated machines.

No wonder this New England concern bids successfully on jobs it may never see again. If you are bidding high on similar work, why not get the facts on the 2AB? Call your local Warner & Swasey Office, or write Warner & Swasey Company, Cleveland 3, Ohio.

YOU CAN TURN IT BETTER, FASTER,
FOR LESS...WITH A WARNER & SWASEY

WARNER & SWASEY

CIRCLE 264 READER SERVICE CARD

The Westinghouse man with the motors brings you—

New Class B Insulation to give you 15% more horsepower on totally-enclosed Life-Line motors

Now Class "B" Insulation replaces Class "A" *as standard* on totally-enclosed 1-250 hp Life-Line a-c motors giving you these advantages:

Added capacity . . . Operation at 15% over nameplate rating without reduction in motor life.

Longer life . . . 80% to 100% longer life at rated loads than motors with Class "A" Insulation.

This newly designed motor is engineered to give top performance in a wide range of applications. On-the-line experience in the steel industry, where maximum reliability is essential, has proved its higher output, longer life and lower maintenance under the toughest conditions.

For the ultimate in protection specify Guardistor* on all Westinghouse motors. This exclusive built-in static motor protection allows the use of maximum horsepower over long periods with no danger of motor burnout.† For additional information ask for booklet B-7876-A.

Your Westinghouse sales engineer can supply you with complete details on these money-saving motors. Call him for full information on how they can fit into your production scheme. Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

You can be sure . . . if it's Westinghouse.

*Trademark

Westinghouse

†Warranty: Westinghouse GUARDISTOR MOTORS on frames 182-445 inclusive are guaranteed for one year against burnouts due to overheating resulting from: overload, locked rotor, blocked ventilation, bearing seizure, single phasing, unusual duty cycle, high ambient, or voltage unbalance, providing the Guardistor elements are connected in a control circuit so that the motor is removed from the power source in the event of over-temperature.

J-22170

Time is the measure of productivity

Time is the measure of productivity
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Reduce grinding time and you increase productivity. Norton's many time saving innovations in varied stages of grinding production can reduce your grinding time up to 30%! The story is a profitable one. Here's why —

Norton Grinding Machines are engineered to permit higher wheel speeds to reduce cutting time. Norton's *Automatic Wheel Balancer* balances the wheel in *five seconds— on the machine.* You reduce time spent "grinding air" up to 85% because of Norton's *Automatic Wheel Contact Accelerator* which speeds the wheel to the work and compensates for work piece-diameter variation. Another advance is Norton's *Automatic Truing* which eliminates work interruptions and the *Automatic Wheel Wear Compensator* that stabilizes the grinding cycle.

Norton Grinders further add to your productivity by minimizing work spoilage with *Automatic In-Process Gaging.* In the case of surface grinders Norton *Higher Table Speed of 150 fpm* actually reduces grinding time up to 50%.

These are only some of the many reasons you can increase your productivity with Norton Grinders. They also offer accessories that literally transfer skills to machines — *ultra-fine feed,* and *automatic features* such as *steady resting, endwise locating, loading, constant peripheral wheel speed* and *hydraulically-operated feed screws* provide this competitive advantage.

The decision is yours — can you afford not to reduce the time it takes to produce your product? Can you afford not to increase your productivity? Contact your Norton man, NORTON COMPANY, Machine Tool Division, Worcester 6, Mass. District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. In Canada: J. H. Ryder Machinery Co. Ltd., Toronto 5.

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — **BEAN-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes
MACHINE TOOL DIVISION: Grinding and Lapping Machines — **G & E DIVISION:** Shapers • Gear Cutting Machines

NORTON
MACHINE TOOLS

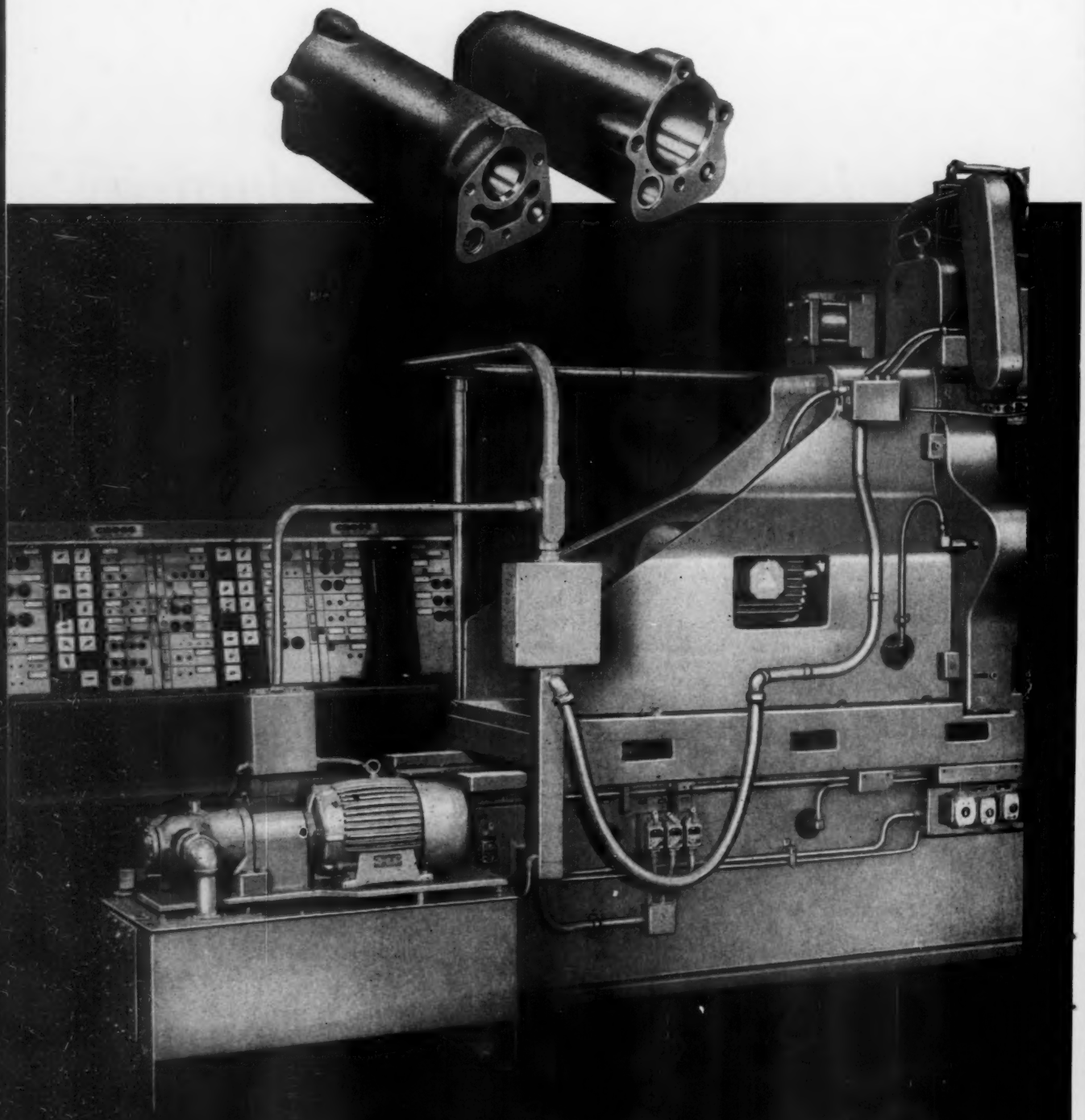
Making better products... to make your products better

▲ CIRCLE 268 READER SERVICE CARD

CIRCLE 269 READER SERVICE CARD ▶

New Cross Trunnion Machine with Greater Flexibility

Processes remote accessory cylinders of different designs and different materials



Another Automation First by Cross

Recent developments by Cross have resulted in trunnion machines that perform a variety of operations on families of parts with improved accuracy and at a higher rate of production than previous equipment.

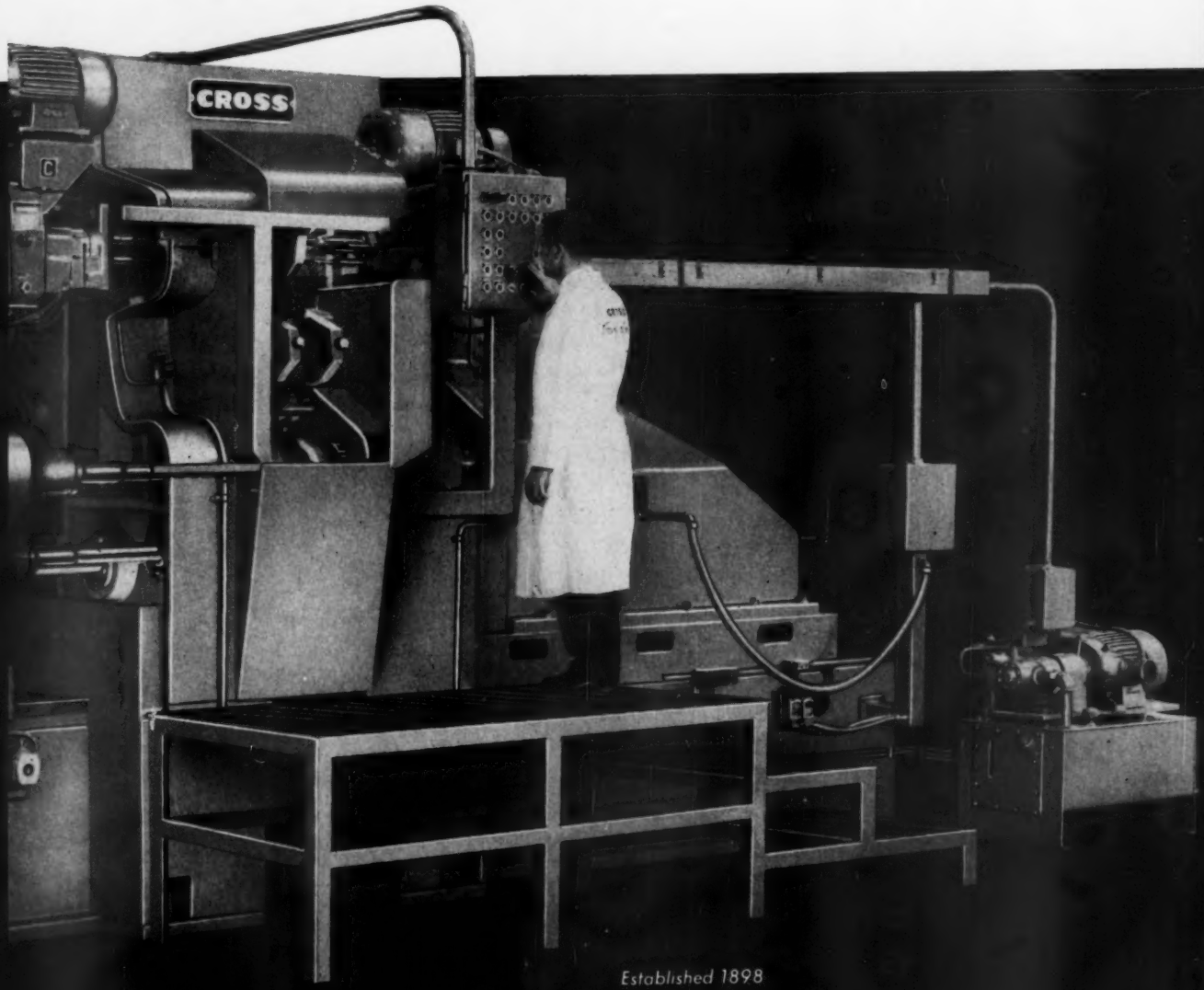
A typical application of the new design concept is the processing of remote accessory cylinders which vary in both size and material. Different lengths are handled by changing a few tools, replacing some fixture details and adjusting the feed strokes. Both nodular and grey iron castings are processed by changing the speeds and feeds.

Similar operations such as rough, semi-finish and finish boring; drilling; counterboring and chamfering are completed by spindles in the two main heads. Dissimilar work such as tapping, facing and grooving are done by four auxiliary heads.

Extremely close tolerances are maintained through single clamping of the part, precision indexing of the trunnion and boring bars which are accurately guided in the trunnion supports.

Future part design changes can be accommodated easily because of the extreme flexibility of the machine.

A Cross Sales Engineer will be glad to tell you more about this new trunnion machine design.



Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

How's this for **VERSATILITY!**

Using the LAPOINTE

DOUBLE RAM VERTICAL BROACHING MACHINE

one of America's noted truck builders broaches all these precision parts **fast . . . economically . . .**

No lost time, no lost motion is encountered when broaching with this highly-efficient Lapointe-Broaching Machine, as you will see by referring to the production figures shown here. And another significant point is, that the machine is equally effective and economical on short runs.

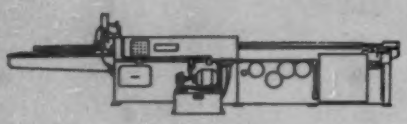
If you are performing certain operations now by conventional methods such as milling, grinding, shaping, etc., you will find that you can cut your production time and improve your surface finish (*and eliminate rejects!*) by Lapointe-Broaching. The greatest potential for cost reduction exists in the field of broaching. We suggest that you invite an experienced Lapointe Field Engineer to help you solve some of your tough production problems.

THE LAPOINTE MACHINE TOOL COMPANY

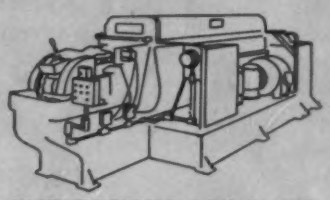
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

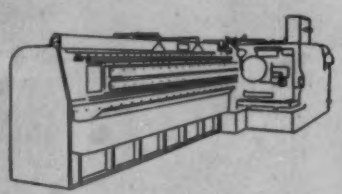
Lapointe-built Broaching Machines are available in hydraulic and electro-mechanical drives.



60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC



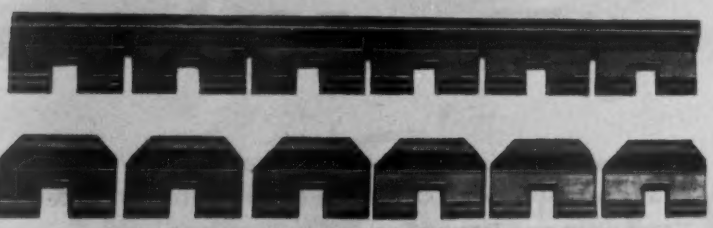
SRHE SINGLE RAM HORIZONTAL, ELECTRIC

◀ CIRCLE 270 READER SERVICE CARD

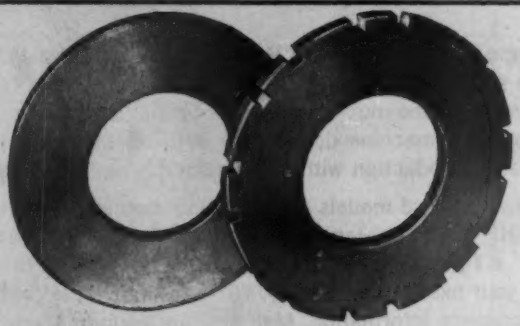
▲ CIRCLE 271 READER SERVICE CARD

FULCRUM, Clutch Pressure Plate Eye Bolt
Production: 500 "cut-up" pieces per hour, at 80% efficiency.

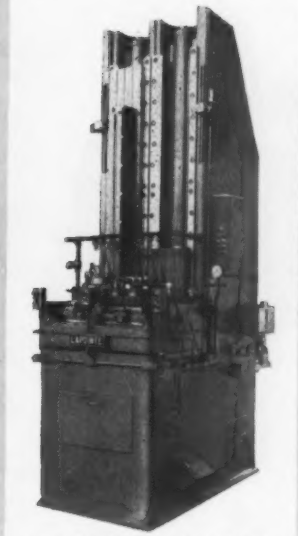
Lapointe-Broached from cold drawn steel strips in two operations: (1) the left-hand ram broaches 6 notches and the cut-off slots; (2) the right-hand ram broaches 45° chamfer which separates the strip into 6 individual pieces.



. . . . . on one machine!



Before and after broaching.



Lapointe 10-ton, 66-inch stroke Double Ram Vertical (DRV) Surface Broaching Machine, equipped with Lapointe In-and-Out Master Fixture Tables.

Before and after broaching on right-hand ram.

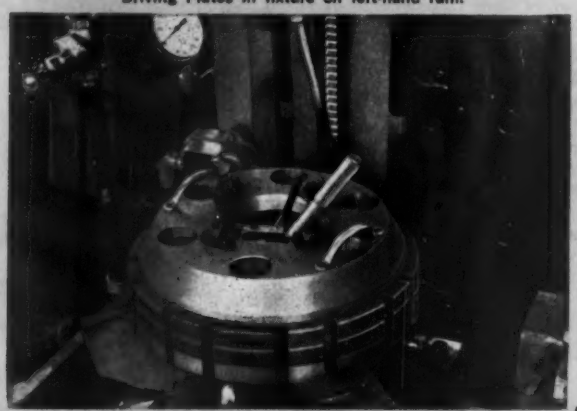
PIVOT, Clutch Release Lever
Production: 180 per hour, at 80% efficiency.

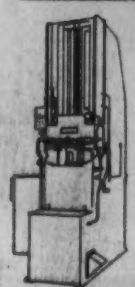
The flat face of this pivot is Lapointe-Broached two-at-a-time (side by side) on one ram, while the other ram is simultaneously broaching the Driving Plates.

DRIVING PLATE with 16 slots
Production: 6 complete plates per hour, at 80% efficiency.

Lapointe-Broached from the solid, comprising 16 rim slots on each part. Broaching 2 stacked parts on one ram of the machine, the production is 96 slots per hour—less than 40 seconds per slot!

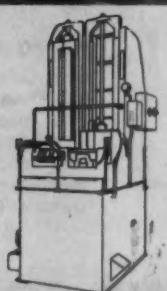
Driving Plates in fixture on left-hand ram.





VUE-7 VERTICAL PULL-UP ELECTRIC

SRVE SINGLE RAM VERTICAL, ELECTRIC



DRVE DOUBLE RAM VERTICAL, ELECTRIC

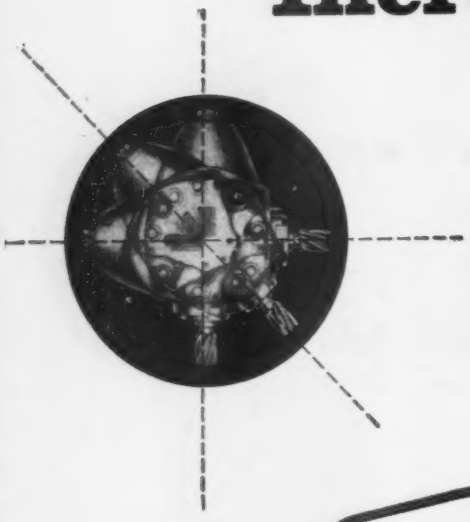
LAPOINTE

known to be the best in

BROACHING

All industry is talking about the new Van Norman

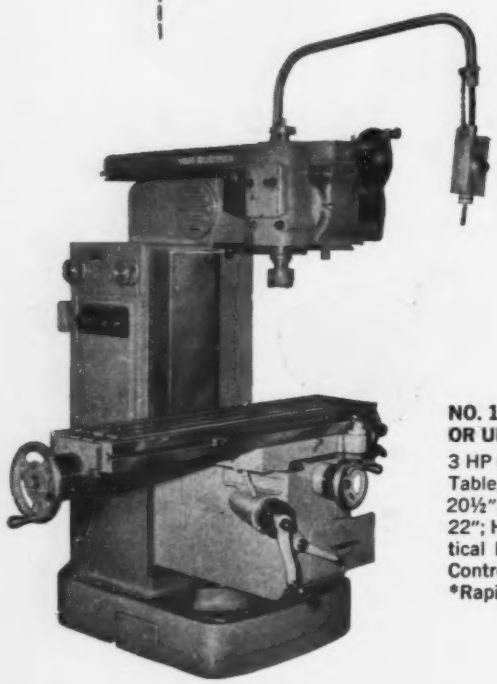
Increase Production Van Norman



Horizontal, Angular or Vertical Milling are at your finger-tips with ONE Van Norman Ram-Type Miller. Versatility and Range Pay Off in Performance

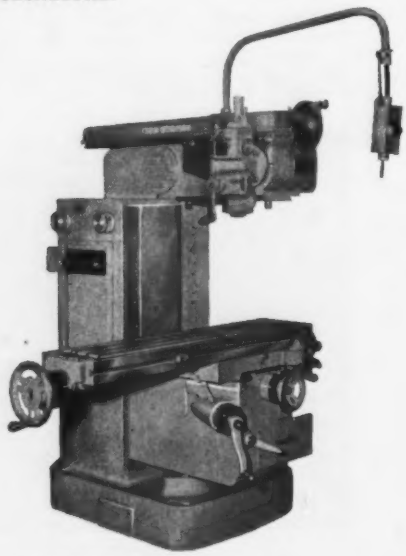
A single investment in one Van Norman Ram-Type Milling Machine gives you the equivalent of two separate millers plus attachments at the much lower cost of a single machine. Not only do you save machine dollars, but with a Van Norman you get increased production with substantial savings in milling costs.

14 new standard models — cutterhead motors from 3 to 10 HP (*15 HP optional)—table sizes from 42½" x 10" to 64" x 14" (*72" x 16" optional). You thus have a wide range of selection to fit your needs most exactly. Write for individual catalogs giving complete information. Mail to: Van Norman Machine Company, Springfield 7, Massachusetts.



NO. 1R (22-3)—PLAIN OR UNIVERSAL

3 HP Cutterhead Motor; Size of Table, 42½" x 10"; Ram Travel 20½"; Power Longitudinal Feed 22"; Hand Cross Feed 10"; Vertical Hand Feed 24"; Pendant Control.
*Rapid Traverse Knee Elevating



NO. 1RQ (22-3)—PLAIN OR UNIVERSAL

3 HP Cutterhead Motor; Size of Table, 42½" x 10"; Ram Travel, 20½"; Power Longitudinal Feed 22"; Hand Cross Feed 10"; Vertical Hand Feed 24"; Pendant Control; 4" Quill Travel; 3 Power Feeds (.0015" - .003" and .006" Feed per revolution).
*Rapid Traverse Knee Elevating
*Optional Equipment

FOR YOUR CONVENIENCE..
NEW NUMBER DESIGNATIONS FOR VAN NORMAN MACHINES

1	R	Q	22	3
Class	Ram Type	Quill Spindle	Table Travel	Spindle HP

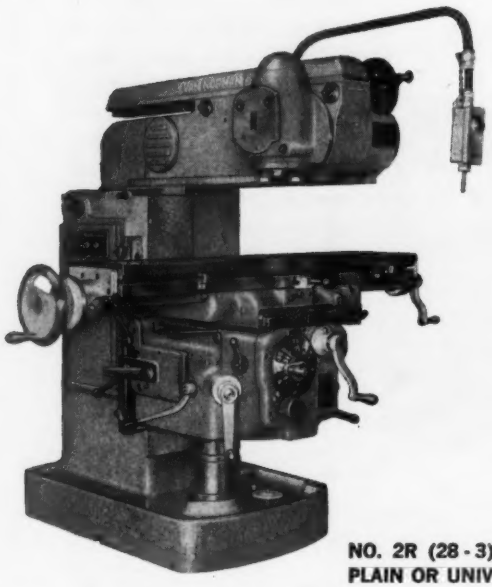
4121

VAN NORMAN MACHINE COMPANY

VN

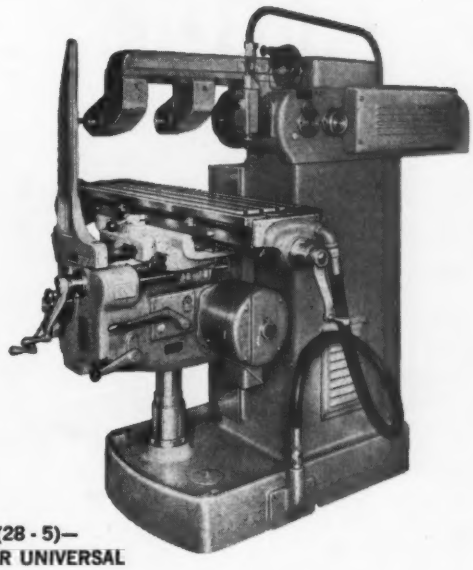
SPRINGFIELD 7, MASSACHUSETTS • DIVISION OF VAN NORMAN INDUSTRIES, INC.

Efficiency with Ram-Type Millers



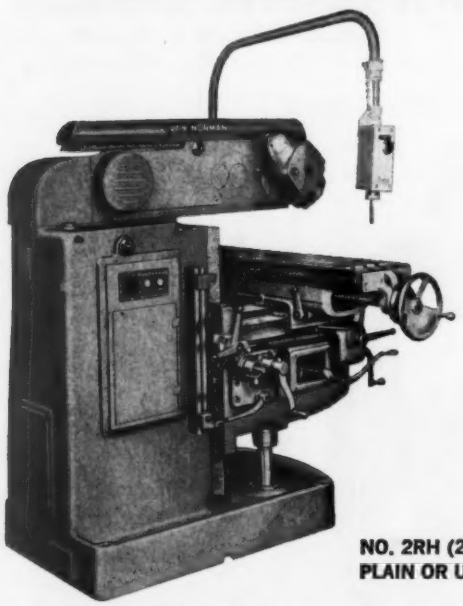
NO. 2R (28 - 3)—
PLAIN OR UNIVERSAL

3 HP Cutterhead Motor. Size of Table: 50" x 10½". Ram Travel: 29". Power Longitudinal Feed 28". Power Cross Feed 12". Power Vertical Feed 18". Rapid Traverse (6 Directions); Pendant Control; Front and Rear Hand Controls.



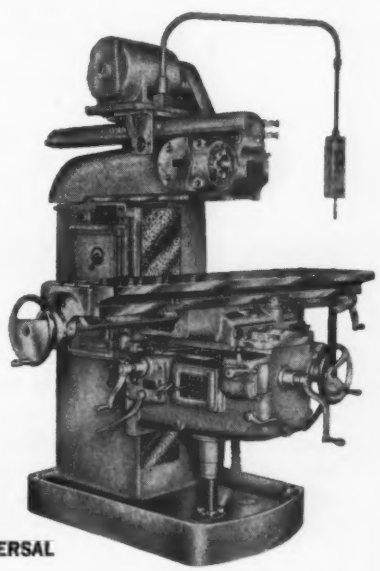
NO. 2R (28 - 5)—
PLAIN OR UNIVERSAL

5 HP Cutterhead Motor. Size of Table: 50" x 12". Ram Travel 25". Power Longitudinal Feed 28". Power Cross Feed 12". Power Vertical Feed 20". Rapid Traverse (6 Directions); Pendant Control; Front and Rear Hand Controls.



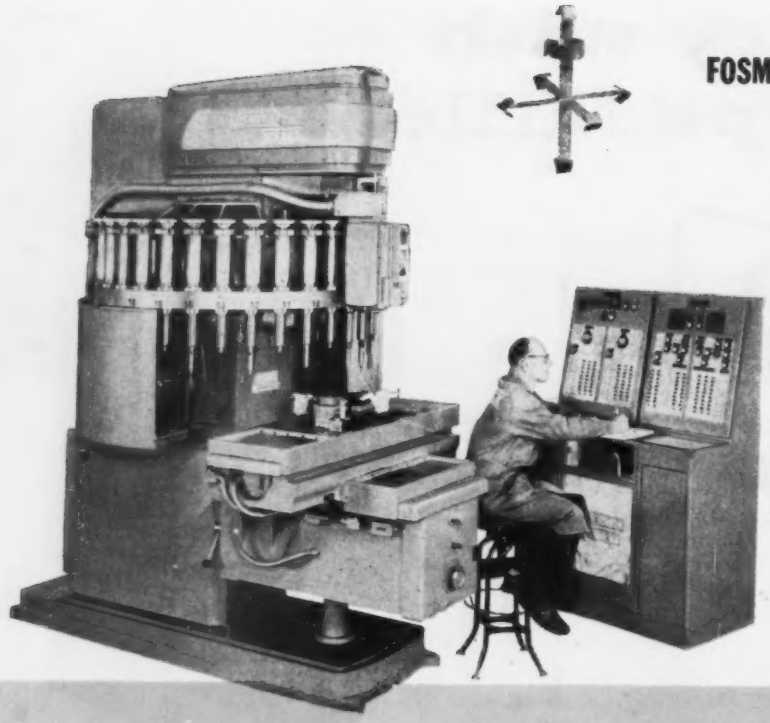
NO. 2RH (28 - 7½)—
PLAIN OR UNIVERSAL

7½ HP Cutterhead Motor. Size of Table: 58" x 13". Ram Travel 29". Power Longitudinal Feed 28". Power Cross Feed 14". Power Vertical Feed 20". Rapid Traverse (6 Directions); Pendant Control; Front and Rear Hand Controls.



NO. 38MA—
PLAIN OR UNIVERSAL

10 HP Cutterhead Motor. Size of Table: 64" x 14". Ram Travel 29". Power Longitudinal Feed 35". Power Cross Feed 14". Power Vertical Feed 21¼"; Rapid Traverse (6 Directions); Pendant Control; Front and Rear Hand Controls Automatic Backlash Eliminator with Plain Saddle.



FOSMATIC N/C TURRET DRILL

The drill that carries its own "tool crib". Machine hundreds of different parts without changing tools. Full 3-dimensional tape control including rapid tool selection with the 32-spindle turret. Combined General Electric Mark II and Fosmatic numerical control makes this unique, heavy-duty machine an efficient producer for drilling-tapping-milling with lot sizes as small as one!

NUMERICAL CONTROL *for more effective, lower cost*

DRILLING • TAPPING • MILLING

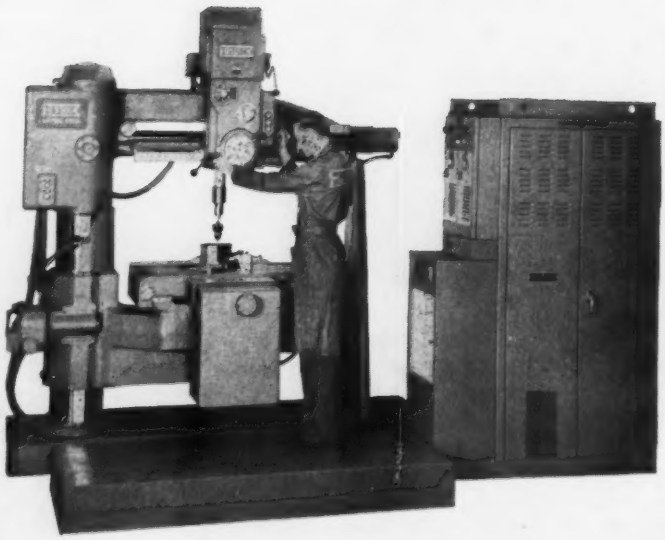
Get a proposal from

FOSDICK

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

FOSDICK N/C LAYOUT DRILL

Keep costs low with this economical machine built to speed drilling and tapping jobs through your shop. Great versatility. Simple in concept, easy to operate. Proven, fast General Electric Mark II numerical positioning control, with full zero offset. The best buy in numerically controlled drills.



NUMERICAL CONTROL FOR PRODUCTIVE PRECISION BORING

FOSMATIC N/C PRECISION BORING MACHINES

Four models from the compact "32" with 18″ x 30″ table travel, to the big "54" with 28″ x 48″ travel. All available with Fosmatic electro-mechanical tape control for table position, spindle depth, head height, speeds, feeds, and tool changing. Fosmatic control positions workpiece accurately to ± .0001″. Fosmatic jig borers make provision for numerical control in the basic design and can be furnished in any degree of automation. See specifications below.

SPECIFICATIONS: FOSDICK NUMERICALLY CONTROLLED MACHINES

	N/C TURRET DRILL	N/C LAYOUT DRILL	N/C PRECISION BORING MACHINES (Jig Borers) Model 32	Model 42	Model 44	Model 54
Table working surface, in.	18 x 31	24 x 42	18 x 32	18 x 42	44 x 22	54 x 22
Table travel, in.	18 x 24	18 x 32**	18 x 30	20 x 36	22 x 42	28 x 48
Spindle nose to table, in.	3 - 23	3 - 23½	4 - 22½	4 - 28½	6 - 30	6 - 30
Spindle center to column, in.	19½	9 - 43	16½	16½	18½	18½
Head or knee travel, in.	12	16½	9½	15½	15	15
Spindle travel, in.	8	12	9	9	9	9
Spindle speeds, rpm	65 - 2500	75 - 1500*	62 - 3000	62 - 3000	30 - 1800	30 - 1800
Spindle feeds, ipr	.0006 - .012	.004 - .020*	.0005 - .015	.0005 - .015	.0005 - .015	.0005 - .015
Motor hp.	3	3	3	3	3	3
Numerical control	GE Mark II —Fosmatic	GE Mark II	Fosmatic	Fosmatic	Fosmatic	Fosmatic

*other ranges available **travel of head on arm

The Fosdick Machine Tool Co., Cincinnati 23, Ohio FOSDICK

A NEW HIGH NOTE IN HEEL FASHIONS

WITH COLD FINISHED STEEL BARS

Only steel could do the job. The designs for women's new super-slim, high-fashion heels required greater strength. Small diameters must withstand terrific pressure. The material must give, not break.

As have thousands of other manufacturers confronted with new product designs, heelmakers found the answer in a Bliss & Laughlin cold finished steel bar.

Bliss & Laughlin cold finished steel bars are used in countless products. They impart high strength with safety, from high-fashion heels to automobiles. They make small boys happy with sturdy bicycles and model engines. They help transmit power to huge earth-moving equipment and giant ocean liners.

Check out your designs with Bliss & Laughlin. As specialists in strength, finish, accuracy, straightness and machinability for 70 years, Bliss & Laughlin has recommended time and again the most suitable and economical bar from the industry's most complete line of cold finished steels.

Seven Bliss & Laughlin mills across the nation, collaborating with Steel Service Centers everywhere, assure highly personalized, local service!

The smallest cross section in this heel is only .14". Strength is provided by a C-1144 cold finished steel bar, heat treated to a Rockwell hardness of 35-38 after machining.

BL-617

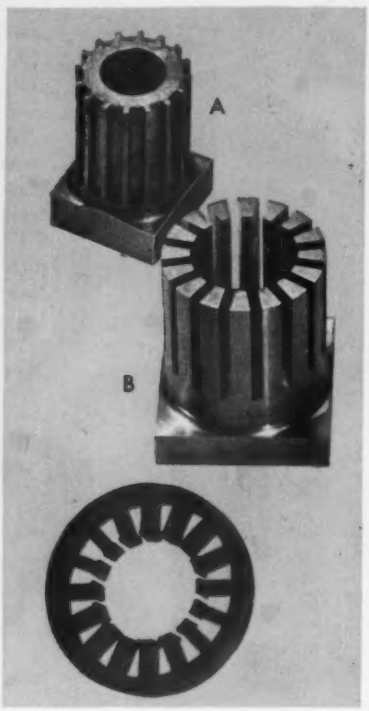
Leading Independent Producer of Cold Finished Steel Bars

BLISS & LAUGHLIN

GENERAL OFFICES: Harvey, Ill. MILLS: Harvey, Ill., Detroit, Cleveland, Buffalo, Mansfield, Mass., Los Angeles, Seattle

CIRCLE 278 READER SERVICE CARD

On this Sheffield-Cavitron® Ultrasonic Machine Tool is shown the set-up for machining a motor laminator of ferrite — a material with the hardness of sapphire and the machinability of glass. Illustrated separately are a finished laminator and the two cutting tools involved. The smaller tool (A) first machines the small slots around the center of the ⅛" hole in the laminator to a tolerance of ±.001". The larger tool (B) then machines the 16 wedge-shape slots simultaneously, concentric with O.D. and I.D. within .002" T.I.R. "Working" this complex ferrite shape is typical of the capability of Sheffield Ultrasonic machine tools and NORBIDE boron carbide abrasive in broadening the machinability of modern materials.



Now it's easy–

with ultrasonic machining

...using NORBIDE* boron carbide

Yesterday, materials like ceramics, refractories and various new alloys were regarded as too hard or too brittle for conventional machining. Today, precision-machining these and many other materials is routine with ultrasonic machine tools.

Equally routine in this rapidly expanding field of machining is the use of NORBIDE boron carbide. Recommended by Sheffield and other machine tool builders, this Norton-developed abrasive has proved itself the ideal cutting agent.

Driven by a vibrating ultrasonic force, far beyond the range of the human ear, NORBIDE grit hits the work with an impact of 150,000 times the grain's own weight — *without fracturing.* Second only to diamonds in hardness and recognized as much more effective than silicon carbide grain, the Norton achievement is so free from impurities that every ounce delivers high-precision, trouble-free cutting action with maximum power and longest life.

Get more facts from your Norton Man on this tremendous advancement in modern machining. Find out how it can help you improve and economize your own production. See your Norton Distributor or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

NORTON
BORON CARBIDE

G-417

Making better products . . . to make your products better

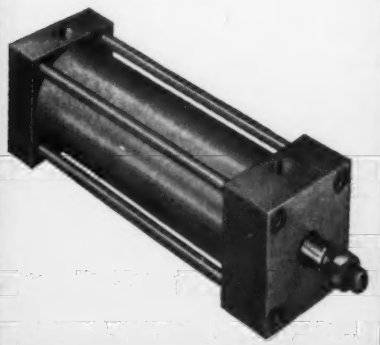
NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

NEW FROM HANNIFIN

A GENERAL PURPOSE AIR CYLINDER

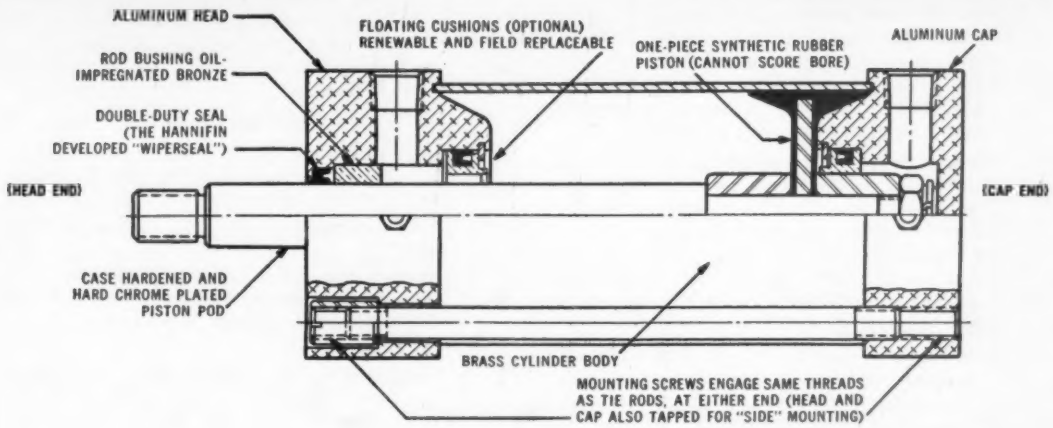
that gives you quality, low cost and mounting versatility

Hannifin announces a new design concept that gives you quality and economy in one package, the new Series "C" air power cylinder with . . .



- One compact basic design that provides side, cap end, or head end mounting without modification.
- Flange, foot or pivot mountings easily made with standard attachments.
- Rust proof construction — brass cylinder body, head and cap of aluminum.
- Cushions that do not change cylinder length—furnished as option or added in field with simple kit.
- An ingenious one piece piston that cannot score the bore—of synthetic rubber, molded around a rugged steel disc.
- Piston rod both case hardened and hard chrome plated, polished to a fine finish for low friction and long seal life. Corrosion resistant.
- Rod bearing an oil impregnated bronze bushing. Minimizes friction.
- Gland seal the Hannifin developed "Wiperseal"—both a rod wiper and an efficient dynamic seal. It keeps air in, dirt out.
- 5 bore sizes—1¼", 1¾", 2½", 3¼" and 4½". Stock strokes from 1" to 20" in 1" increments.

This new Hannifin cylinder design is the latest of the complete Hannifin line of air power cylinders. To help you choose the best Hannifin cylinder for your application, talk to your nearby Parker-Hannifin man. He knows cylinders!


ALUMINUM HEAD
ROD BUSHING OIL-IMPREGNATED BRONZE
DOUBLE-DUTY SEAL (THE HANNIFIN DEVELOPED "WIPERSEAL")
(HEAD END)
CASE HARDENED AND HARD CHROME PLATED PISTON POD
FLOATING CUSHIONS (OPTIONAL) RENEWABLE AND FIELD REPLACEABLE
ONE-PIECE SYNTHETIC RUBBER PISTON (CANNOT SCORE BORE)
ALUMINUM CAP
(CAP END)
BRASS CYLINDER BODY
MOUNTING SCREWS ENGAGE SAME THREADS AS TIE RODS, AT EITHER END (HEAD AND CAP ALSO TAPPED FOR "SIDE" MOUNTING)

PARKER HANNIFIN CORPORATION

HANNIFIN COMPANY

A DIVISION

517 South Wolf Road • Des Plaines, Illinois

PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS

3420-PH

EUROPEAN DIVISION • PARKER-HANNIFIN N. V. • SCHIPHOL • THE NETHERLANDS

LOCTITE GIVES YOU

THE IMPOSSIBLE PERFECT FIT

Only a small percentage of the adjacent metal surfaces of a press or interference fit are actually in contact. Yet the security of the entire assembly depends on that small area of contact.

Rigid tolerances are specified, and extra machining operations are performed to increase the area of contact. Nevertheless, it has been impossible to mate two metal surfaces perfectly, one inside the other. The Perfect Fit, like Infinity and Perpetual Motion, has seemed to exist only in theory.

YET A FEW DROPS OF LOCTITE CAN NOW PROVIDE WHAT THE MOST EXPENSIVE OF MACHINING METHODS CANNOT.

LOCTITE Sealant is a penetrating liquid resin that by capillary action is drawn into all the voids in a press or interference fit, filling them completely. Once there, LOCTITE hardens automatically into a tough, solid, load-bearing plastic film, capable of supporting loads in excess of 25,000 pounds per square inch, thus providing *A PERFECT FIT* of adjacent surfaces.

FACTS ABOUT LOCTITE SEALANT:

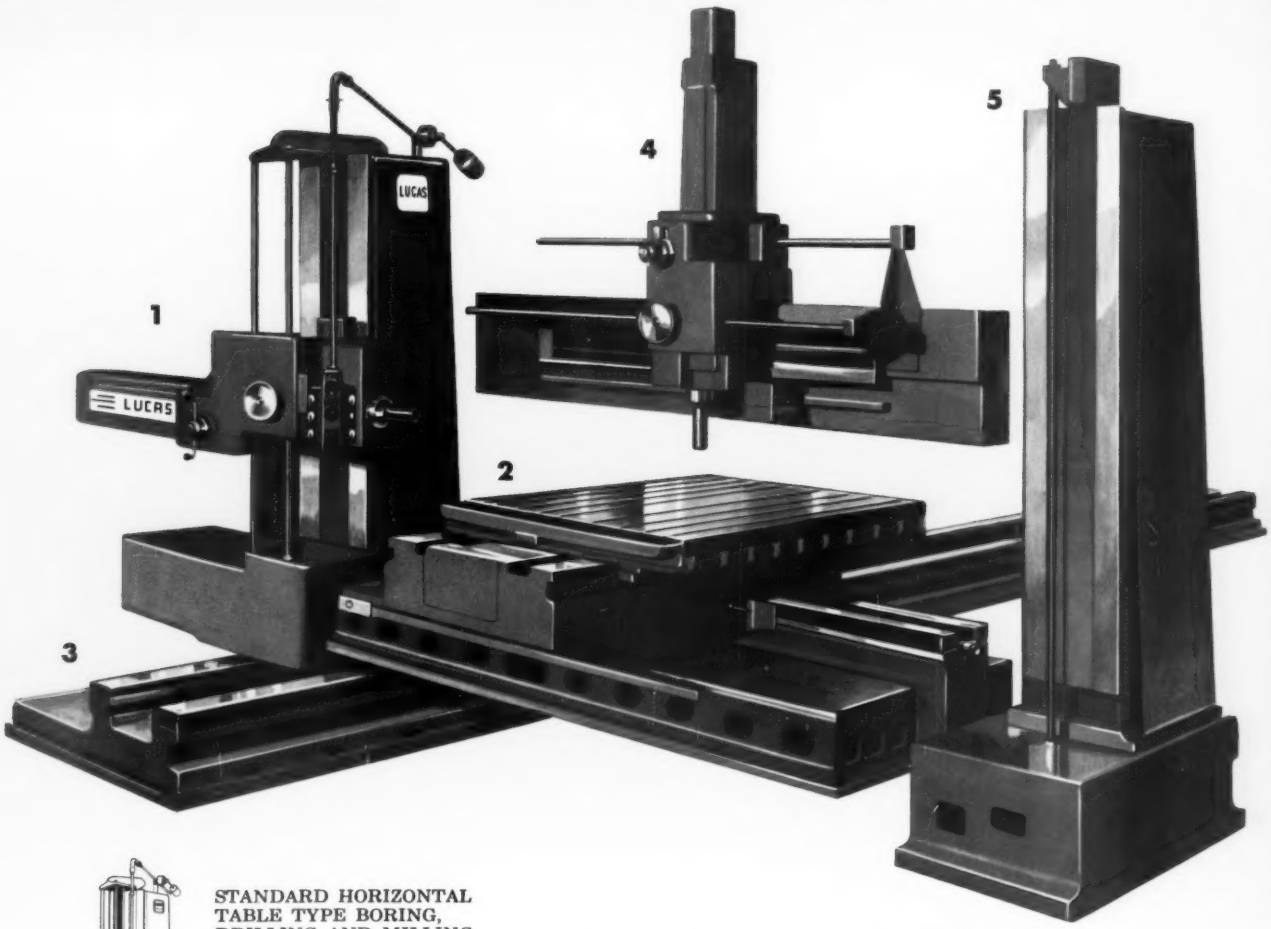
- LOCTITE is easy to use. It requires no mixing or heating.
- LOCTITE is 100% active. It totally fills the voids in press fits and threaded assemblies.
- LOCTITE contains no solvents—requires no solvents. There is no hardening shrinkage due to solvent evaporation.
- LOCTITE requires no expensive equipment. The bottle is the applicator; or mass application procedures can easily be set up with "around-the-shop" parts and materials.
- LOCTITE will withstand temperatures up to 300°F.

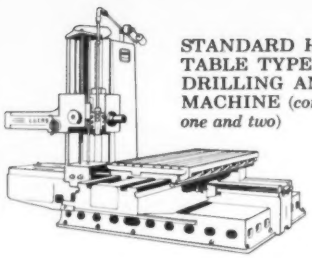
LOCTITE Sealant makes a slip fit as strong as a press fit, a press fit stronger. It can be used to relax tolerances and to improve reliability.

Wherever metals are LOCKED—RETAINED—SEALED there is an opportunity to cut costs and increase profits with LOCTITE. Details on your application bring immediate response from our Application Engineering Department. Write today.

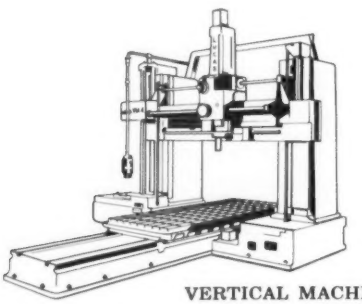
LOCTITE® SEALANT

AMERICAN SEALANTS COMPANY
121 North Mountain Road • Hartford 11, Connecticut

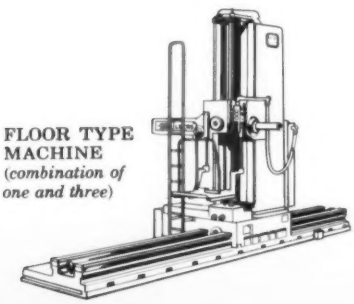




STANDARD HORIZONTAL TABLE TYPE BORING, DRILLING AND MILLING MACHINE *(combination of one and two)*



VERTICAL MACHINE *(combination of one, four and five)*



FLOOR TYPE MACHINE *(combination of one and three)*

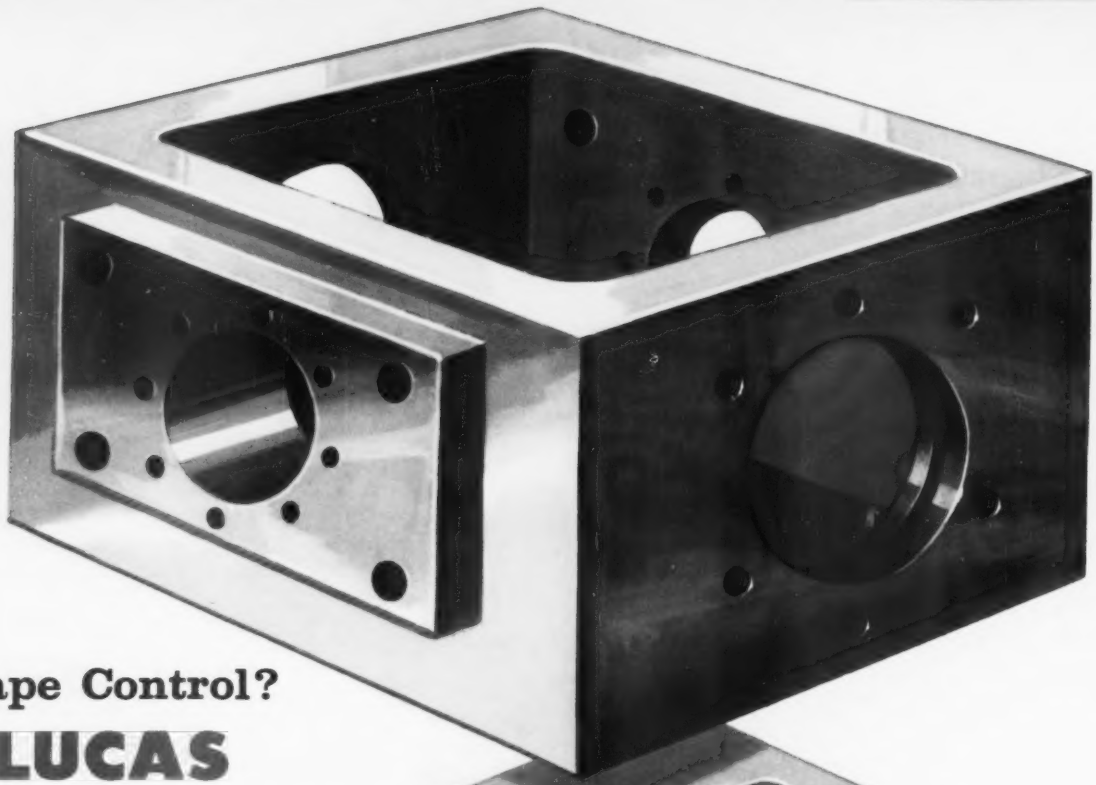
Versatility of Design?

LUCAS

Each Lucas machine—table type, floor type, or vertical—is, in effect, a composite of basic precision-made components, *with integrally cast beds*, assembled to meet your specific requirements. This progressive building-block approach to boring, drilling and milling machine design results in (1) the widest range of field-tested machine models, (2) the same high standards of performance regardless of which type machine you specify, (3) the widest possible range of work with the least number of extra gimmicks and gadgets for so-called "special" jobs. When you want the best that your machine tool dollar can buy, talk to the people who pioneered in the development of the horizontal boring, drilling and milling machine. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Ave., Cleveland, Ohio.

NOTE: In order to better define the basic components, we have shown main bed castings separated. In actuality, all bed castings are massive integrally cast units providing maximum rigidity for highest precision.

LUCAS
PRECISION

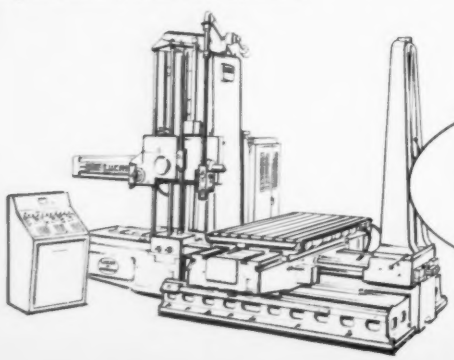


Tape Control?

LUCAS

By offering the widest range of precision table type and floor type boring, drilling and milling equipment . . . by being able to perform the widest range of point-to-point and contouring work . . . by closely coordinating our efforts with the leading producers of numerical controls, Lucas is better able to provide the numerically controlled boring, drilling and milling machines you require.

No longer something to read about and think about, good tape controlled equipment is working hard in more and more plants to provide the competitive edge that spells the difference between profit and loss. A numerically controlled Lucas can help you now to cut lead time in the form of direct and indirect labor, reduce inventory, greatly reduce or eliminate jigs and fixtures, eliminate human error, etc. The list is a long one and your Lucas representative is the man who can spell it out book, chapter and verse. Review your requirements with him for a knowledgeable proposal for a numerically controlled Lucas to fit your specific needs. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio.



LUCAS
PRECISION

CARBORUNDUM
QUALITY
SANDPAPER
CARBORUNDUM
QUALITY
SANDPAPER
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CARBORUNDUM
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CARBORUNDUM
QUALITY
SANDPAPER

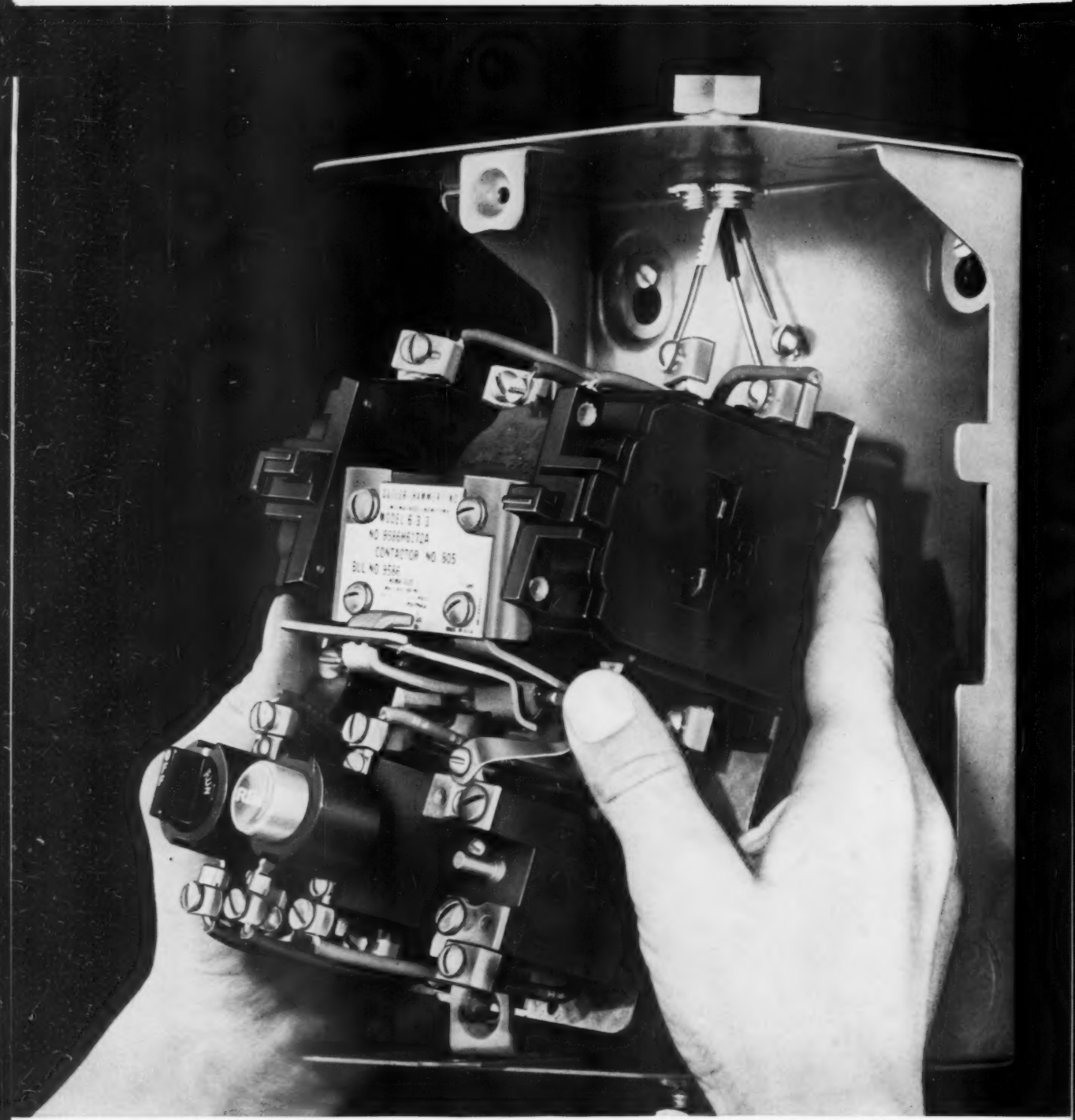
Carborundum® sandpaper sheets, belts, discs and Economy® Rolls are deliberately designed to pay real dividends in small-job sanding—for all hand applications, and portable or bench machine work. They cut faster and finish more uniformly, because they are made under the same rigid controls, and from the same fine abrasive materials, as the most technical coated abrasive products. Their cost is small—but the savings they bring can substantially reduce your overall expense.

Give your Carborundum distributor a few minutes to show how Carborundum quality—backed by his own abrasive knowledge and service—can help you.

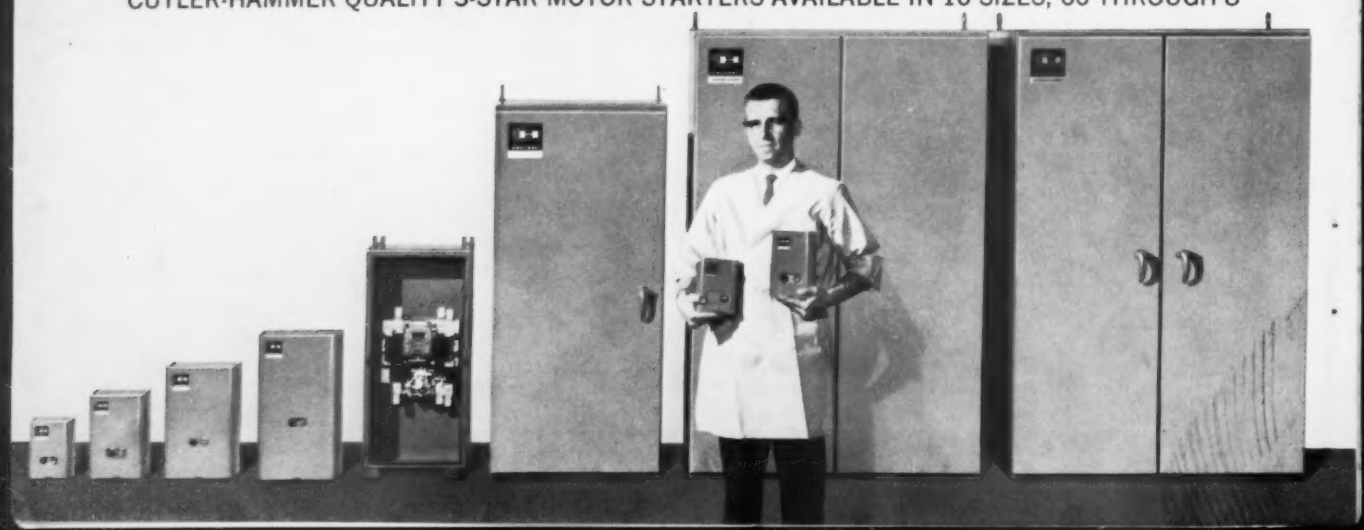
CARBORUNDUM

◄ CIRCLE 283 READER SERVICE CARD

CIRCLE 284 READER SERVICE CARD



CUTLER-HAMMER QUALITY 3-STAR MOTOR STARTERS AVAILABLE IN 10 SIZES, 00 THROUGH 8



CONTROL

CUTLER-HAMMER MOTOR STARTERS

Still the proven standard of quality...always in stock for immediate delivery

Millions of satisfactory operations in thousands of applications have proved the unmatched quality of Cutler-Hammer across-the-line magnetic starters. That this line is still recognized as the leader—nine years after the original design was developed—is a great tribute to the years-ahead thinking of Cutler-Hammer engineers.

FIRST IN '53—STILL THE LEADER IN '61

Since the Three Star line was introduced in 1953, many improvements have been made; magnet coils that far exceed NEMA standards, for example. But many achievements of the original design—vertical, dust-free contacts; overload relays adjustable to within 3% of actual full-motor ratings; provision for 2 or 3-coil overload relays in the same enclosure—are features no other manufacturer has been able to improve. You can safely bet that when these pace-setting features are improved, it'll be another Cutler-Hammer development.

ALWAYS AVAILABLE FOR FAST DELIVERY

You'll find the smaller sizes of Cutler-Hammer Starters always in stock at your local distributors—larger sizes immediately available from the factory. We hope you'll make your own feature-by-feature comparison between the Cutler-Hammer line and any other starter on the market. Look especially carefully at such vital advantages as ease of installation, high interrupting capacity, coil construction and accessibility.

Regardless of what features you select as the criterion of superiority, we're sure you'll choose Cutler-Hammer after you've made your unbiased comparison.

If you're one of many companies being forced to stock two sets of parts because of design changes, now is an excellent time to standardize on Cutler-Hammer.

Call your distributor or local Cutler-Hammer Sales Office soon. Or write for Publication LO-70-Q239

WHAT'S NEW? ASK..

CUTLER-HAMMER

CONTROL

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Cutler-Hammer Canada, Ltd.; Cutler-Hammer Mexicana, S. A.

POSITIVE DUPLICATION—EVERY TIME!

With these three metronomes—or with a thousand—the time interval you choose can be positively duplicated time after time. And with these three PD* surface wheels—as with *all* CINCINNATI PD GRINDING WHEELS—you'll get the same kind of Positive Duplication *every time*!

HERE'S WHY . . . IN 36 STEPS

There are 36 unvarying quality control steps in Cincinnati's unique PD manufacturing process. Right from the start with the choice of the "grains" that go into a wheel, PD procedures involve exacting checks and re-checks. Every grain characteristic—from size, cleanliness, absence of foreign matter, color, magnetic content, to bulk density before and after blending—must fully satisfy extraordinary PD specifications, which are followed throughout in all 36 rigid controls.

RESULT: PREDICTABLE PERFORMANCE

You can depend on the uniformity of PD WHEELS—for each reorder wheel gives you exactly the same good job as the original. Production goes up and stays up. Costs go down and stay down. This is the promise—and performance—of Positive Duplication.

CALL CINCINNATI TODAY

Solve your grinding problems with the help of our Cincinnati-trained specialists. Their wide experience in job set-ups and grinding operations is at your service. Just call your CINCINNATI PD GRINDING WHEEL Distributor, or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

PD POSITIVE DUPLICATION

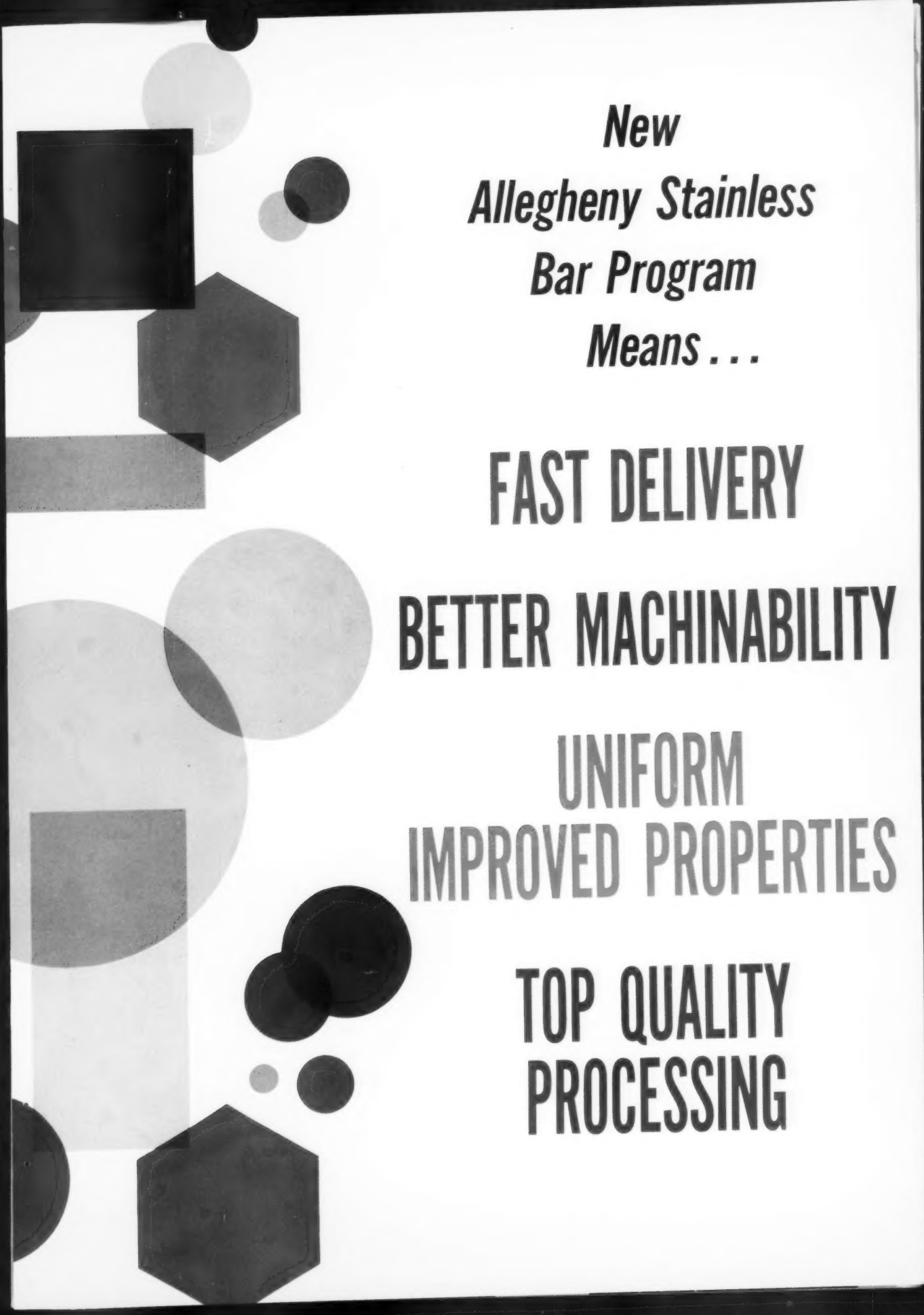
CINCINNATI®
GRINDING WHEELS

*Trade Mark Reg. U. S. Pat. Off.

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

CIRCLE 287 READER SERVICE CARD

CIRCLE 288 READER SERVICE CARD ►


New
Allegheny Stainless
Bar Program
Means . . .
FAST DELIVERY
BETTER MACHINABILITY
UNIFORM
IMPROVED PROPERTIES
TOP QUALITY
PROCESSING

FAST DELIVERY—

5,000,000 lbs. of finished bars
8,000,000 lbs. of semi-finished stocks
to back-up distributor inventory

Allegheny Ludlum now stocks at the mill depots, Rounds, Hexagons, Squares, Flats and Forging Billets in the ten most popular grades that account for over 85 percent of all stainless bars made. This huge stock of over 2,500 tons backs up the large inventories carried by the authorized Allegheny Ludlum Distributors.

In addition to the finished stock, over 4,000 tons of quality checked rerolling billets and ingots in 30 grades are in inventory to cut delivery time and to insure predictability.

Each month, A-L publishes a Bar, Wire, and Forging Billet Stock List which lists the grades, sizes, and actual pounds of each in stock at the first of that month. It's available to you through the Steel Service Centers authorized to sell A-L Stainless Bars. For the names of the distributors in your area, just call the A-L District Office.

BETTER MACHINABILITY—

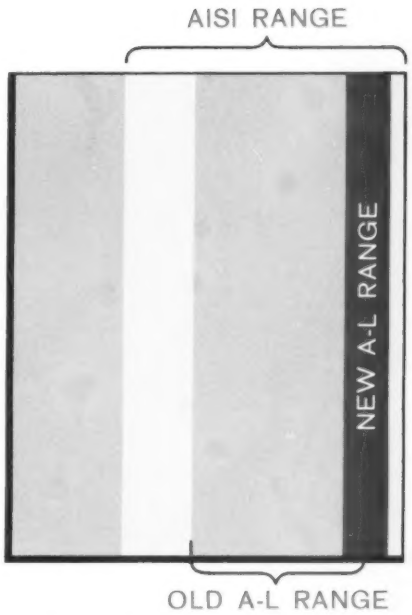
Research, Constant Testing and Controlled Processing Result in Greatly Improved Machinability and Uniformity . . . from Lot to Lot

Several years ago, A-L took a hard look at its own stainless steel bars. While quality was good, it could be made better and more uniform, particularly in the area of machinability.

One of the finest metalcutting laboratories in the country was retained to make independent, exhaustive comparative tests on A-L stainless bars and competitive bars. Ratings were based on tool life, determined by turning and drilling tests. A-L's Research Center, probably the largest in the stainless business, correlated these results with metallurgical factors such as composition, microstructural and mechanical properties.

From Research to the melt shops went instructions to revise and narrow the limits of composition. This, combined with processing changes, yields general purpose (stocked) grades with predictable, better machinability.

RESULT: Testing general purpose machining grades as made three years ago with the same grades made today shows better than a 50 percent increase.

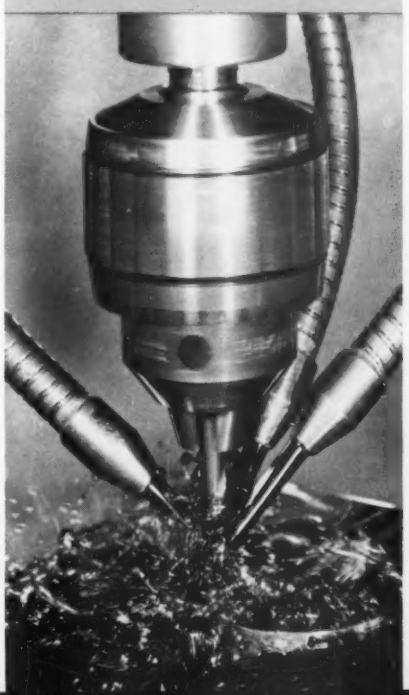


ANALYSIS LIMITS

Allegheny Stainless composition limits, already much tighter than AISI Specifications, have been narrowed even further to improve the composition-sensitive machining properties of all A-L Stainless Grades.

MACHINING TESTS

Exhaustive turning and drilling tests on stainless bars of all types pin-pointed the composition and processing variables that most affected machining properties, and made possible the adjustment of these variables for improved machinability and predictability of response from heat to heat. A continuing program of these machining trials serves as an additional safeguard to the quality and unmatched dependability of an A-L Stainless Bar.



TOP QUALITY PROCESSING—

Special Care and Special Equipment Mean Better Bars at Your Machines

What's been your big trouble with cold finished stainless steel bars . . . nicks and gouges, off-size, burred ends, grinding marks, damaged shipments? Glance over the panels at the right, and see how these common faults are eliminated from Allegheny Ludlum cold finished stainless bars.

These are precautions that make a difference between an A-L quality bar and all the others . . . quality you can see, and feel, and measure. Quality that shows up in bar automatics, in all your fabricating.

And this quality is no accident. A few years ago, Allegheny Ludlum investigated stainless bars from the customer's viewpoint. A-L teams held field interviews, toured customer's plants, watched stainless bars undergoing every conceivable fabricating operation. A good part of the trouble was in mill finishing. And A-L revamped their entire finishing operation to suit.

Special equipment is installed, and every operation becomes a matter of painstaking care. Rubber padding covers every work table and inspection table, lines every transfer buggy . . . chain and cable slings are eliminated, and soft rope substituted . . . cardboard collars are fitted to bars in process, to prevent rubbing and scratching.

Quality Audit Teams continually audit and maintain quality control standards by making pinpoint quality checks through every phase of production . . . right onto the shipping dock.

Many of these practices have been widely imitated in the industry. Some are still A-L exclusives. But, this is how quality is made . . . stainless steel bar quality . . . by the world's leading stainless steel producer.

HEAT NUMBERS ON EVERY BAR

Heat numbers stamped permanently on one end of the bar won't wear off, can't get separated. Square, clean-cut and deburred ends make use in bar automatics easier and make chucking simpler.

CONSISTENT SIZE AND STRAIGHTNESS TOLERANCES

A-L's famous quality control and inspection procedures mean greater uniformity . . . minimizes special handling in your plant.

NICK-FREE, SCRATCH-FREE BARS

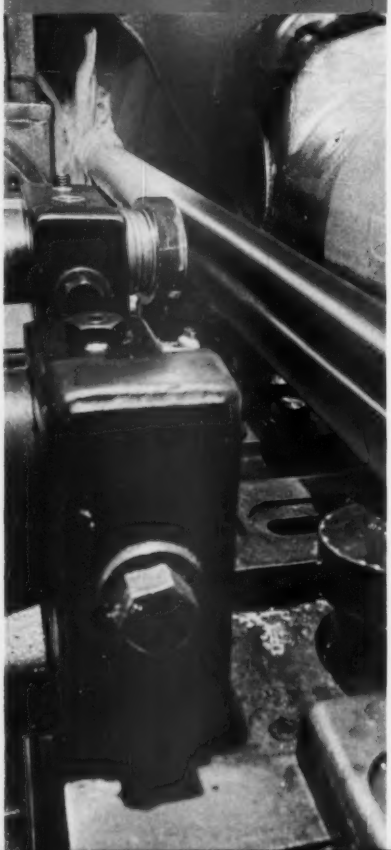
Nothing harder than cardboard, ropes or rubber ever touches finished A-L bars. Cardboard collars eliminate sliding, metal-to-metal contact . . . chain or cable are never used.

SMOOTHEST FINISH AVAILABLE

Consistent metal quality and careful finishing result in a surface vastly superior to the industry-accepted average standard.

CAREFUL FINISHING PAYOFF

Multiple passes through centerless grinders result in smooth finish—no spiral grind marks —no chatter marks.



PROTECTED SHIPMENTS

All bars are protected with cardboard collars and then the bundle is completely wrapped with triple-thickness waterproof paper to protect the superior finish during shipment. Reduces damage in transit.

And if You Want Something Special A-L is a Complete Bar Source

HIGH TEMPERATURE STEELS & ALLOYS

A-L stocks certain finished bars in the most commonly used high temperature steels and alloys plus a large stock of approved billets in these same grades. Needs for bars of A-286, 19-9DL, AM-355, Waspaloy, AL 901, R 41, S-816, M-252, etc., are usually quickly satisfied from this finished and semi-finished stock of Allegheny Ludlum.

FORGING BARS & BILLETS

Also in stock is a full range of forging-quality bars and forging billets from 4 to 30 inches Round Cornered Squares in a wide range of grades, all meeting appropriate specifications.

SPECIAL ANALYSIS AND PROCESSING

For special requirements, A-L is able to tailor-make properties to fit the end use. From knowledge gained in the machining research program, chemistry and processing can be varied to increase a specific property for a particular application. Improvements in such things as hot workability, cold workability, hardenability, finish after machining, improved machinability in non-free machining steels, mechanical properties, corrosion resistance, are examples.

It's something you should discuss with your A-L sales representative.

MACHINING AND HEAT TREATMENT DATA

A-L mill and research specialists are available, through the A-L sales representatives, for help and counsel on problems involving Allegheny Stainless Bars. Qualified machining engineers are at your service. These men devote their full time to provide the best service and assistance available anywhere.

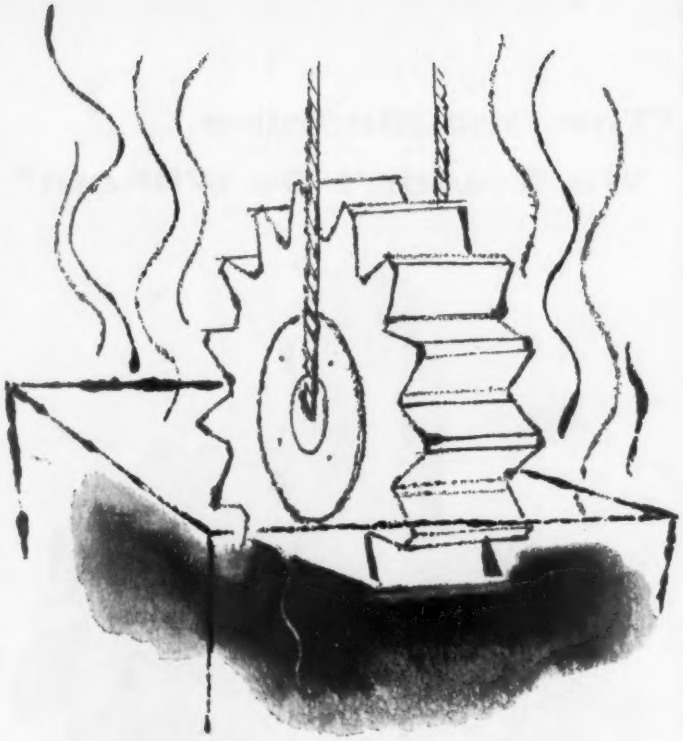
NEW BAR BOOKLET

On the printing press now is A-L's new booklet, jam-packed with helpful information on using, heat treating and machining Stainless Bars. For a copy of this technical, data-filled booklet, check the A-L authorized distributor in your area, or the A-L Sales Office nearest you, or write: ***Allegheny Ludlum Steel Corporation, Department QIP 3, Oliver Building, Pittsburgh 22, Pa.***

ALLEGHENY LUDLUM

EVERY FORM OF STAINLESS . . . EVERY HELP IN USING IT

3473



Quenching... hardness... and how to save money

Spotty hardness can be a costly problem. The solution is a quenching oil that permits maximum uniformity of hardness. Sinclair QUENCHOL® 521 is unexcelled in this respect. It has a reputation, too, for increasing the depth and the degree of hardness. When you try it, you'll find QUENCHOL 521 surprisingly superior on all classes of steels. Refill now. Next time management asks how you've cut costs, tell them you've switched to Sinclair—and show them the results.

Find out more about QUENCHOL. Call your nearest Sinclair Representative or write Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. There's no obligation.

Sinclair

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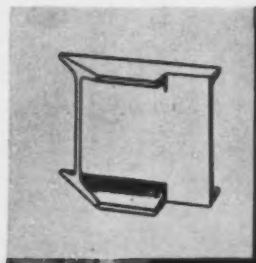
QUENCHOL® Quenching Oils

◄ CIRCLE 289 READER SERVICE CARD

CIRCLE 290 READER SERVICE CARD



COPING AND MITERING HEAVY STRUCTURAL SHAPE

18" Beam (above) is held between vises for the short cut. On the long cut (left) vises were removed and beam held by simple clamp. The MARVEL Band Saw is truly indispensable in ornamental and structural iron shops where this type of work is done daily. The machine will cut-off square, miter and cope any work shape from the smallest moulding to 18" I-beams.

SPLITTING CLAMP RINGS, BUSHINGS

Splitting clamp rings, connecting rods, bushings and collets is a fast, simple operation on the No. 8 Band Saw. Perfect control, quick chucking facilities, accuracy and speed are features that especially fit the machine to handle this type of work.

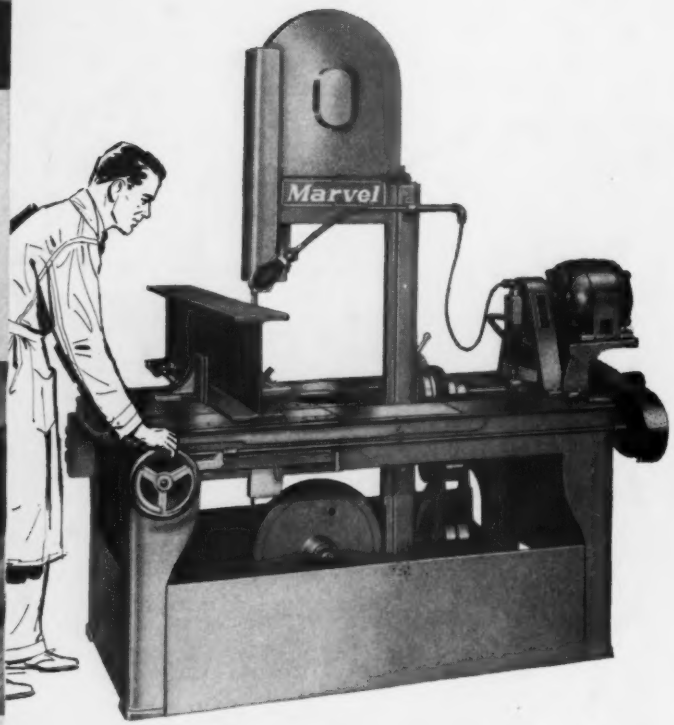
MITERING LARGE DIAMETER PIPE

Pipe (or any bar shape) may be mitered at a 45° angle without the need for special jigs or fixtures. Even when cutting miters, work remains in the same position as it does for straight cuts. Column and blade are instantly tilted to desired angle, even without stopping the machine. Perfect miters (or lesser angles) are sawed without any layout or special equipment.

SEGMENTING LARGE DIE BLOCK

Three equally spaced re-entrant cuts were made in this 16" x 18" SAE 4130 Forging. Job was completed, floor-to-floor in 5 hours. No special jigs or fixtures were required. An unusual job that serves to emphasize the versatility of the MARVEL No. 8 Saw.

"The One Machine We Couldn't Do Without"



"As simple to use and handy as a Scout Knife" is the way another user described his MARVEL No. 8 Universal Band Saw recently . . . and we can't think of a better way to describe this versatile metal cutting machine.

With a MARVEL No. 8 Band Saw, you can do almost any conceivable straight, angle, or miter metal sawing job—from cutting-off bar stock to making the most unusual forming cuts. You can handle small, delicate work, and in the next minute, saw structurals, or segment large work as illustrated in the lower photograph. You will save time, labor, and material with a MARVEL No. 8 Band Saw because no other saw has all the features to be had in this truly universal tool.

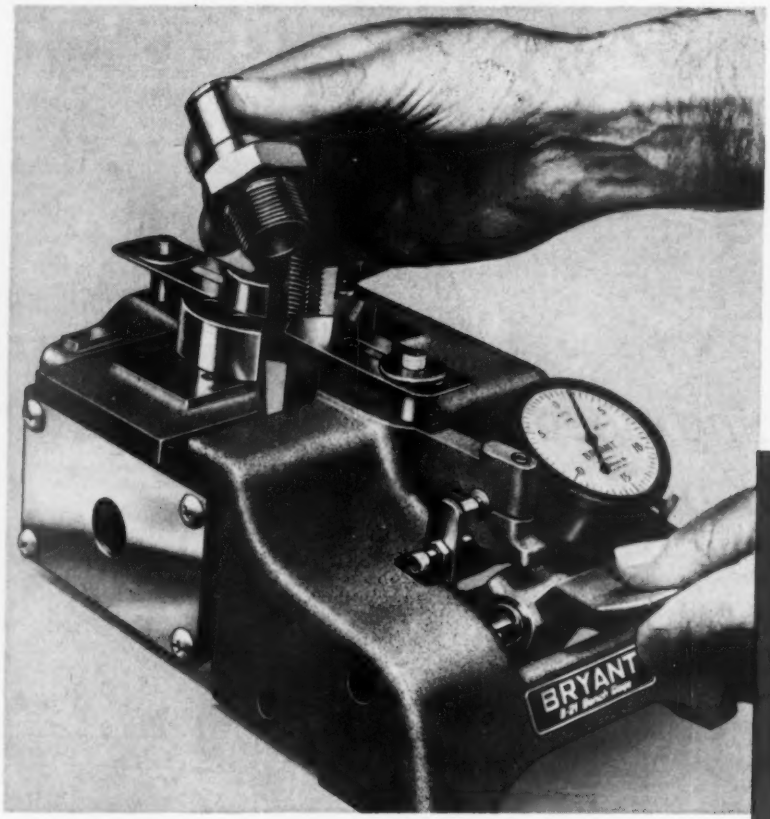
Upright column design and forward travel of the blade through the work (which remains stationary on the table-height saw bed) provides easy, unobstructed visibility and more convenient and efficient working conditions; column can be tilted and locked at any angle up to 45° left and right of vertical; the exclusive MARVEL Power Feed with Automatic Overload Relief; Automatic cutting-depth stops; simple, convenient operating controls—these are some of the features which make the No. 8 Band Saw the most useful—and used—metal cutting saw on the market.

For the complete story, ask or write for Bulletin 875 which illustrates and describes MARVEL Universal Metal Cutting Band Saws.

MARVEL Metal Cutting SAWS
Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 N. BLOOMINGDALE AVE. • CHICAGO 39, ILL.

Q. How many gages needed to make these thread and groove checks?



- OD "Go check"—size #0 to 5" dia.
- ID "Go check"—size #3-48 to #10-24*
- ID "Go check"—size #10-32 to 5" dia.
- ID "PD check"—size #6 to #8*
- ID "PD check"—size #10-24 to 5" dia.
- ID snap-ring, O-ring and special groove checks—size 0.239" to 10" dia.

*Spin-on

Photo above shows precision gage segments for checking #4-48 ID threads.

Left, above: depressing lever retracts B-21 gage segments for fast loading of OD threaded part.

A. <u>One</u> Bryant B-21 Bench Gage!

Using interchangeable gaging segments, the Bryant B-21 Precision Bench Gage quickly and accurately checks a wide range of bored, threaded and grooved parts. Add optional attachments and accessories as needed, and a single B-21 becomes a universal "inspection station," ready to change in minutes from such jobs as checking squareness of face of parts from 2" to 7" OD, to checking bore concentricity!

See your Bryant Gage Representative, or write direct for prices, design details and application data.

61-62B

EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

EX-CELL-O CORPORATION

Greenville Plant, 945 E. Sater St., Greenville, Ohio

IDEAL

LIVE CENTERS

meet most turning needs at lowest center point cost

UNIVERSAL models for super accuracy to .0001, high load capacity, perfect for grinding and other high-precision work.

MULTI-DUTY models for general use, perfect for light work, interchangeable parts provide quick changeover for multi-purpose operations.

HEAVY-DUTY models for extra rugged work, give close tolerance results where high load capacity is required, accurate to .0002.

PIPE POINT models for cylindrical turning of pipe, axles and other hollow shapes, six sizes from 3¼" to 7½" dia.

Over 40 sizes...with all popular tapers... in four styles...to choose from. That's how Ideal helps you meet your turning needs for the heaviest work to the lightest of light jobs.

Ideal Live Centers are guaranteed to provide the highest accuracy required, exactly matching the lathe size you use. What's more, they are custom quality designed and manufactured by production methods to give you the lowest possible precision center point costs.

You can get Ideal Live Centers from your distributor's stocks. He'll give you *immediate delivery service*—which reduces your inventory requirements and cuts your investment costs. If you need a special, we'll be glad to work with him to meet your specifications at the *right* price.

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS
In Canada: IRVING SMITH, Ltd., Montreal

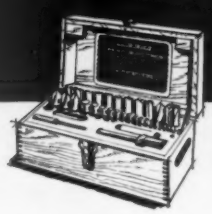
Write for new LIVE CENTER Catalog

IDEAL INDUSTRIES, Inc., 1057-H Park Avenue • Sycamore, Illinois

Cost-Cutting—

A SIMPLE MATTER OF SELECTION

59-15

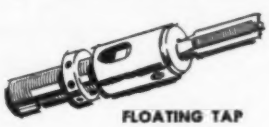


COUNTERBORE SETS

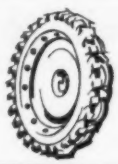
INVERTED SPOT FACERS

COUNTERBORES—

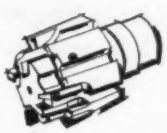
COUNTER SINKS, HOLDERS, PILOTS



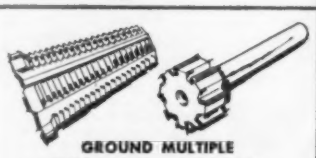
FLOATING TAP DRIVERS



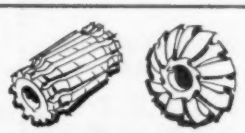
INSERTED BLADE FACE MILLS



MULTIPLE DIAMETER BORING CUTTERS



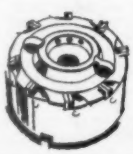
GROUND MULTIPLE THREAD MILLING CUTTERS



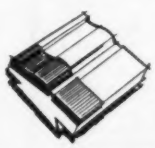
GROUND AND UNGROUND FORM-RELIEVED CUTTERS

SINGLE-POINT CARBIDE TIPPED TOOLS

MULTIPLE STEP BORE REAMERS



CARBIDE TIPPED CYLINDER BORING CUTTERS



DOVETAIL FORM TOOLS

CARBIDE TIPPED BROACH SECTIONS

INVOLUTE SPLINE SHELL TYPE BROACHES

Every standard and special tool is of but one quality—the finest available. Since 1921, Continental has specialized in cost-saving cutting tools (just a few of which are shown at left), producing design innovations in hardened, high-speed tool steel, carbide and special-alloy cutting materials.

Available in the types and sizes required to do the *complete* job from rough to finish, Continental Cutting Tools are job-tested in the toughest proving ground—Ex-Cell-O's own machine tool and precision parts production lines. As a result, they come to you ready to increase the output of even your best machines!

Continental engineers will be glad to work with you in selecting the *correct* CTW Cutting Tool for long life and maximum performance. See your local Ex-Cell-O Representative, or write direct to Continental Tool Works Division for full details. In Canada, contact your local Ex-Cell-O Sales Associates Representative or write direct to Colonial Tool Co., Ltd., Windsor.

Continental **TOOL WORKS**

DIVISION OF

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

CIRCLE 294 READER SERVICE CARD

ARMSTRONG

Drop Forged CLAMPS

LEADERS IN THE DROP FORGED CLAMP FIELD

. . . in design, machining and strength; in completeness of line in both sizes and types.

Designs are based on a full knowledge of clamp uses and requisites. Drop forging assures die-perfect form, texture toughness and freedom from structural faults. Maximum stiffness is attained by a discerning selection of steels with accurate controlled heat-treating, tempering and testing. Medium service, extra deep throat and spatter resisting types are equipped with new ARMSTRONG ball-joint swivel pad which will not come off. Pad is optional on tool makers clamps.

In case you do not know who handles the ARMSTRONG Line in your area, we will be glad to supply this information.

For dependability and long useful life, specify and standardize on ARMSTRONG Drop Forged Clamps.

Write for New Catalog 700

ARMSTRONG BROS. TOOL CO.
5215 W. ARMSTRONG AVE. • CHICAGO 46, U.S.A.

EXTRA DEEP THROAT "C" CLAMPS
Provide extra clearance required for some work. Extremely stiff for weight. Screws and hubs are accurately machined and aligned with ground seats; have sliding pin handles and ball-joint swivel pads. Bodies have smooth sand-blast finish.
(11 sizes to 12" opening)

HEAVY DUTY "C" CLAMPS
Universally recognized as strongest "C" clamps made. Longer hub holds screw alignment against terrific side strain; permit tighter clamping and multiplies thread friction against loosening. Alloy steel screws are hardened at point to prevent upsetting. Ground seat.
(8 sizes to 12" opening)

MEDIUM SERVICE "C" CLAMPS
The design and careful selection of steels in this type clamp combine to give it maximum strength and stiffness consistent with convenient weight. Heat treated screw with sliding pin handle and ball-joint swivel pad. Ground seat.
(9 sizes to 18" opening)

TOOL MAKERS "C" CLAMPS
Quality steels, drop forged, heat treated and accurately machined with ground seats. Drop forged screws have both "wing nut" handle for convenience and square necks for tight setting with a wrench. Either "plain" or with ball-joint swivel pad.
(Four sizes: 1", 2", 3" or 4" maximum opening)

SPATTER RESISTANT WELDERS "C" CLAMPS
Extra Deep Throat Pattern (see above). Body, Swivel and Screw are cadmium plated over all to resist welding spatter.
(8 sizes Capacities to 12" opening)

MACHINISTS' CLAMPS

Jaws drop forged, carefully machined and hardened, are extra heavy; will not bend or spring on a short bite and are faced true. Will grip non-parallel surfaces because the under face of the center screw is convex, fitting into a concave seat for tilting.
(Four sizes: Capacities to 4¼" opening)

PARALLEL CLAMPS

Carefully machined from selected grade steel and hardened. Particularly suited for holding work together when drilling or tapping. Rounded jaw ends increase clearance in close quarters. Spring clip holds loose pin in alignment while tightening or loosening.
(3 sizes: Capacities to 2½" opening).

NOW—An Automatic Form and Groove Grinder . . . designed for tomorrow's production requirements!

WORKPIECES—Standard Ex-Cell-O Model 973 takes parts up to 24″ long. Can be equipped for parts with 36″ centers. Workhead adjustable for angular settings.

OPERATIONS—Precision-built for rough, semifinished or finished production grinding.

CONTOURS—Grinds straight, angular and radius grooves, and a variety of forms. Grinds multiple grooves when fitted with two or more wheels.

CYCLING—Fully automatic cycling, including opening and closing hood. Rapid wheel slide advance and return for maximum productivity.

SIZE CONTROL—Automatic wheel dressing after each cycle or any number of cycles. Automatic wheel size compensation after each dressing. (Handwheel graduated to .0002″ for manual setting.)

DRESSERS—Designed for use with all standard Ex-Cell-O Diamond Dressers, or any special rotary diamond-set wheel dressers.

ACCESSORIES—Model 973 is a complete, versatile machine with extensive automatic features. However, it is designed to be easily equipped with automatic work loading and unloading devices, air operated chuck and tailstock and other accessories to meet your special requirements.

DATA AVAILABLE—Contact your local Ex-Cell-O Representative, or write direct for descriptive literature and engineering data.

61—25M

EX-CELL-O FOR PRECISION

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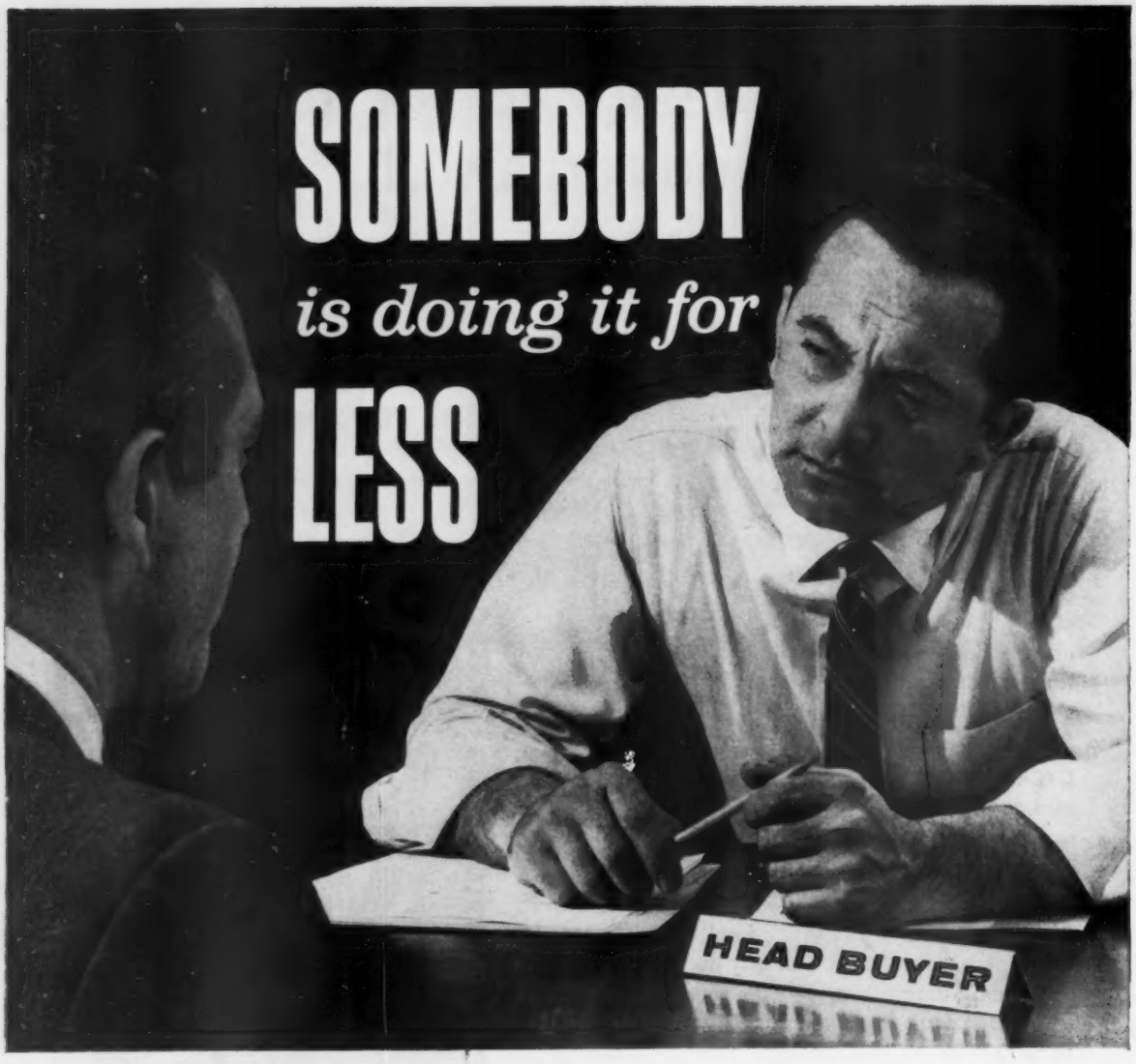
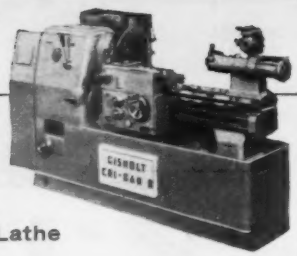
Machinery Division

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

SOMEBODY
is doing it for
LESS





Gisholt CRI-DAN Model B Automatic Threading Lathe

Sets up in 8-15 minutes for maximum profits on job lots or long runs.

Produces single- or multiple-start, standard or special form, left- or right-hand, straight or tapered, internal or external threads right up to shoulders, in a matter of seconds.

Can combine threading with tracing and other machining during the automatic cycle.

Provides top quality and fine finish in any material in a fraction of the time and/or cost required by milling, grinding, or special taps and dies.

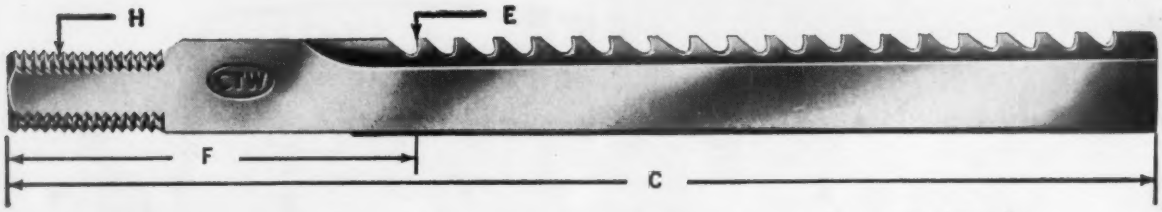
Buyers can't afford to pass up a sales approach based on equipment that cuts threading costs 30-80%.

This advantage is attained with the Gisholt Cri-Dan Threading Method—that uses an inexpensive, single-point, carbide tool to cut *quality* threads in *any* material —*automatically!* Now, you can set up in 8-15 minutes and produce *any* type of thread in a matter of seconds. Accessories combine tracing and standard machining with threading for added savings. If you want to thread for less, *call your Gisholt Representative or write for Catalog 1215.*

GISHOLT
MACHINE COMPANY
Madison 10, Wisconsin, U. S. A.

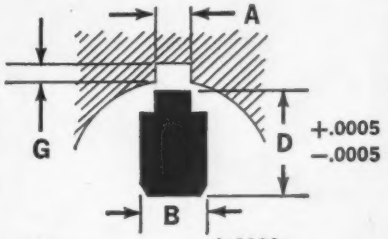
Turret Lathes • Automatic Lathes • Balancers • Superfinishers® • Threading Lathes • Factory-Rebuilt Machines with New-Machine Guarantee

CTW Keyway Broaches in Stock NOW for Immediate Delivery!



Continental now stocks a popular range of standard keyway broaches to help you meet production schedules faster than ever, and to let you cut your tool inventory.

Just call your CTW Representative, or order by catalog number direct from Continental. The broaches you need are in stock now—ready for immediate delivery to your plant!



Sizes listed below are available for immediate delivery. See the CTW Catalog for other standard broaches. Special sizes quickly made to order. Send your print for a prompt quotation.

BROACHING INDUSTRY SERIES

Catalog Number	A Keyway Width			Min. Hole Size	Min.† Length Cut	Max. Length Cut	Width of Body B	Total Broach Length C	Height at Last Tooth D	Height at First Tooth E	Length of Shank F	Keyway Depth in Part G	No. of Cuts	Thread H
	Nom. Dim.	Decimal Dim.	Toler-ance											
502	3/32	.0948	±.0002	7/16	1/2	1 1/2	.1865	24	.367	.309	8 1/4	.058	1	5/16-18
504	1/8	.126	±.0002	1/2	1/2	1 1/2	.249	30	.438	.364	9	.074	1	3/8-16
505	1/8	.126	±.0002	11/16	5/8	2 1/2	.3115	36	.594	.520	10	.074	1	1/2-13
508	3/16	.1885	±.0002	11/16	5/8	2 1/2	.374	36	.581	.476	10	.105	1	1/2-13
512	1/4	.251	±.0002	11/16	5/8	2 1/2	.374	36	.612	.476	10	.136	1	1/2-13
513	1/4	.251	±.0002	1	11/16	4	.499	45	.877	.741	11 13/16	.136	1	5/8-11
514	1/4	.251	±.0002	1 7/16	7/8	6	.624	51	1.250	1.114	13 1/2	.136	1	3/4-10
517	5/16	.314	±.0002	1	11/16	4	.499	45	.908	.741	11 13/16	.167	1	5/8-11
519	3/8	.3765	±.0002	1 1/16	11/16	4	.499	45	.938	.739	11 13/16	.199	1	5/8-11
520	3/8	.3765	±.0002	1 5/16	7/8	6	.499	54	1.189	.990	13 1/2	.199	1	5/8-11
523	1/2	.5015	±.0002	1 1/2	11/16	4	.624	48	1.312	1.051	12	.261	1	3/4-10
524	1/2	.5015	±.0002	1 1/2	1	8	.624	48	1.377	1.246	16 1/2	.261	2	3/4-10
ORIGINAL CTW SERIES														
CTW 7	3/16	.1885	±.0002	11/16	1/2	2 1/2	.375	36	.581	.480	9	.101	1	1/2-13
CTW 10	1/4	.251	±.0002	11/16	5/8	2 1/2	.375	38	.612	.480	9	.132	1	1/2-13
CTW 11	1/4	.251	±.0002	1	11/16	3 1/2	.500	44	.877	.740	10	.137	1	5/8-11
CTW 14	5/16	.3135	±.0002	1	11/16	4	.500	46	.908	.740	10 1/2	.168	1	5/8-11
CTW 17	3/8	.376	±.0002	1 1/16	11/16	4	.500	46	.938	.740	10 1/2	.198	1	5/8-11
CTW 23	1/2	.501	±.0002	1 1/2	11/16	3 1/2	.625	46	1.422	1.160	10	.262	1	3/4-11
ORIGINAL XLO SERIES														
XLO 3	3/16	.1885	±.0002	15/32	15/32	1 3/4	.250	28	.541	.438	8 1/4	.103	1	3/8-16
XLO 5	3/16	.1885	±.0002	5/8	5/8	2	.375	28	.541	.438	8 1/2	.103	1	1/2-13

†MINIMUM LENGTH OF CUT RECOMMENDED TO PREVENT PART FROM DROPPING BETWEEN TEETH OF BROACH

61-33C

Continental CTW TOOL WORKS DIVISION OF EX-CELL-O CORPORATION DETROIT 32, MICHIGAN

Your daily newspaper is a tribute to Air Express priority service

If tomorrow every syndicated cartoon, column and ad in which AIR EXPRESS played a part were missing from your morning paper, you'd know it instantly. The graphic arts, printing, publishing and advertising industries rank high among AIR EXPRESS users. Their engravers' plates, photos and illustrations—even entire newspapers—get top priority on all 10,000 daily scheduled U.S. airlines flights—first on, first off, first there. And they get door-to-door pickup and delivery, too, by a special 13,000-truck fleet—plus kid-glove handling. And just one phone call arranges everything, at amazingly low cost. So always . . . think AIR EXPRESS first!

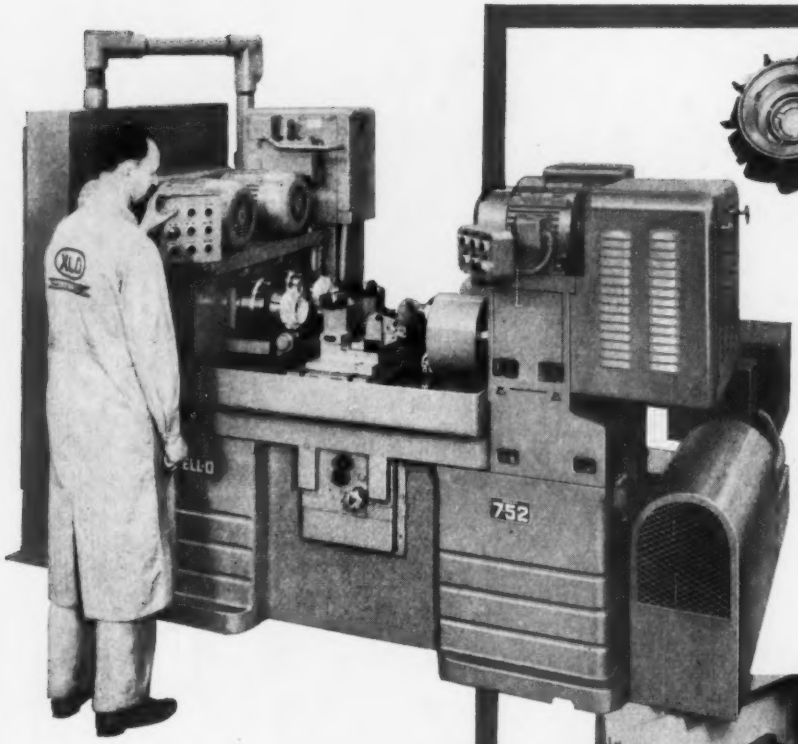
AIR EXPRESS

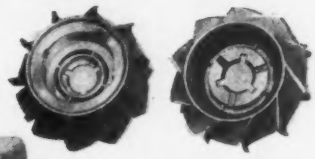
CALL AIR EXPRESS DIVISION OF R E A EXPRESS • GETS THERE FIRST VIA U. S. SCHEDULED AIRLINES

CIRCLE 299 READER SERVICE CARD

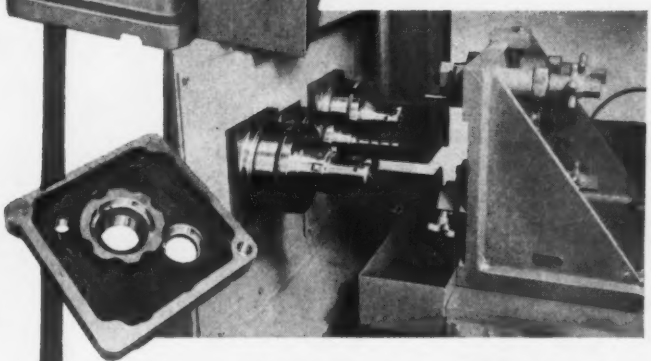
Let the work size, operations, finish or output change . . .

Standard Ex-Cell-Os will meet your needs!





Double-end Model 752 (shown at left) finish-machines both sides of this torque converter stator in one cycle at a rate of 140 per hour. Standard tooling, spindles, and other components permit fast change-over from this job's boring, turning, facing, grooving and chamfering operations to any required single or multiple functions.



Close center-distances are held on this transmission pump cover, one of three different parts finished on a single-end Model 751 Precision Bore. Cross slide indexes during each cycle, and a common spindle bores the dowel holes. One or more Heavy Duty or Ultra-Precision Spindles can be used in place of the three Ex-Cell-O Square Body Spindles shown.

Modern Ex-Cell-Os represent over 30 years of specialization in Precision Boring Machines. Your Ex-Cell-O Representative has data on a wide variety of standard, special and building-block types to quickly provide optimum equipment utilization in your plant. Call him soon, or write direct for details.

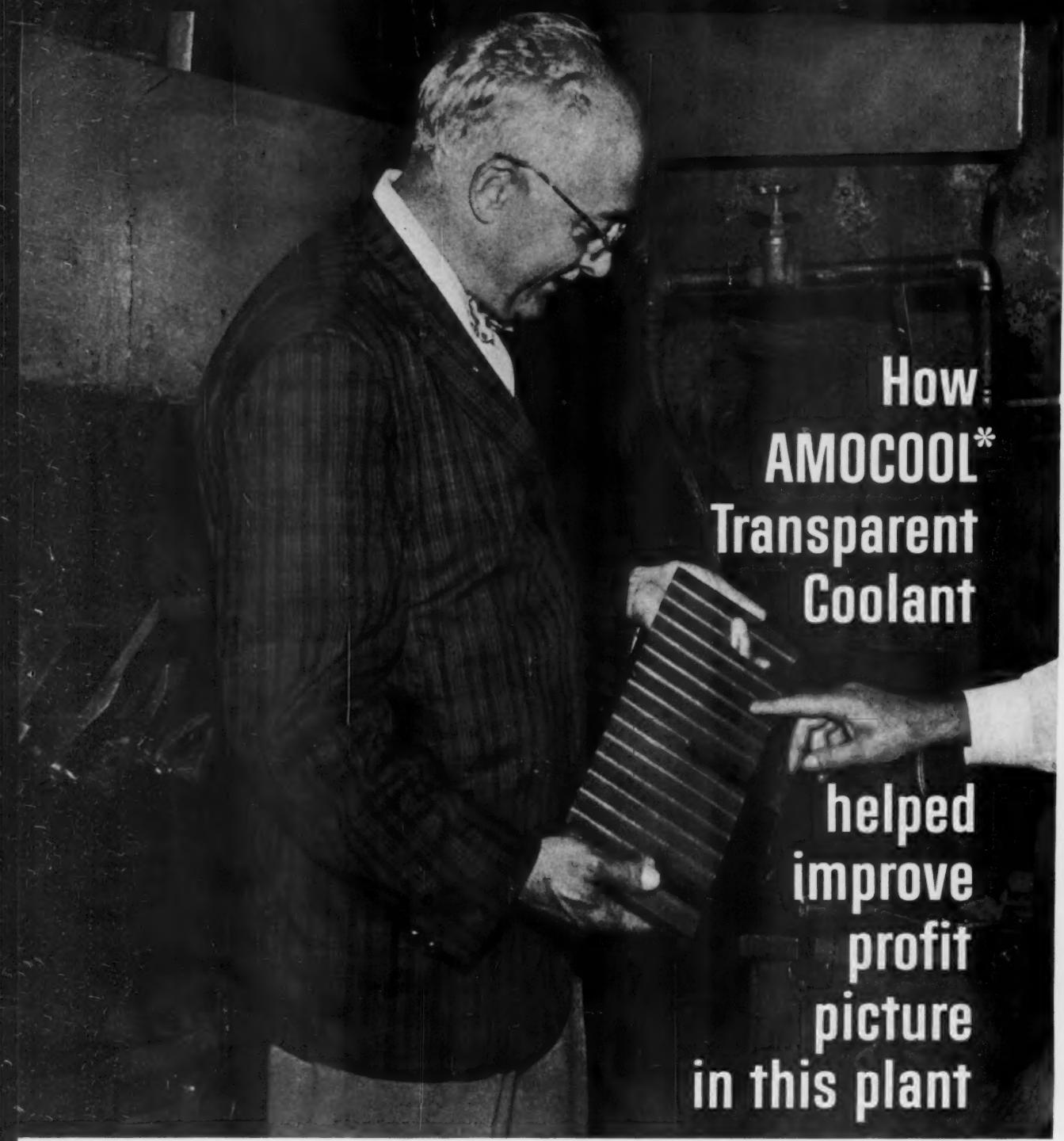
61-16M

EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN



How AMOCOOL* Transparent Coolant helped improve profit picture in this plant

*Trademark

BY PAUL E. "PAPPY" STRATTON

About the Author. "Pappy" Stratton has been providing technical help on lubrication and metalworking problems to customers in the Detroit area for nearly all of the twenty-five years he has been working for the company. In addition to having this store of practical experience to help him, Pappy has completed the Company's Sales Engineering School.

* * *

By using a soap-base grinding compound, Detroit Edge Tool Company was getting excessive corrosion and rust on work and grinding machines. Oil vapor was collecting on machines and on the ceiling, causing dirty working conditions. Most important, high wheel loading was causing frequent down-time for wheel dressings.

We worked out a test program on AMOCOOL Transparent Coolant with the management. On our first test on one surface grinder, feed pressure was cut substantially while at the same time metal removal was increased.

CIRCLE 301 READER SERVICE CARD

Eliminate reworking because of rust, reduce wheel loading and extend intervals between wheel dressings; do these and you increase profit per unit, explains Detroit Edge Tool president, Dan Ebbing, to P. E. "Pappy" Stratton of American Oil. Plant manager, John Yonker (right) and Sam Vineh, operator, look on.

The cost of reworking parts to remove rust was eliminated. Time required to clean machines to get rid of the odor was cut in half. Less wheel loading and fewer wheel dressings have upped production and reduced costs. Our test program paid out in an improved profit picture. All grinding and drilling equipment has been converted to AMOCOOL Transparent Coolant.

* * *

Would you like this kind of technical help to assist you in improving profits? Get it by calling the American Oil Company office nearest you.

Quick facts about
AMOCOOL
Transparent Coolant

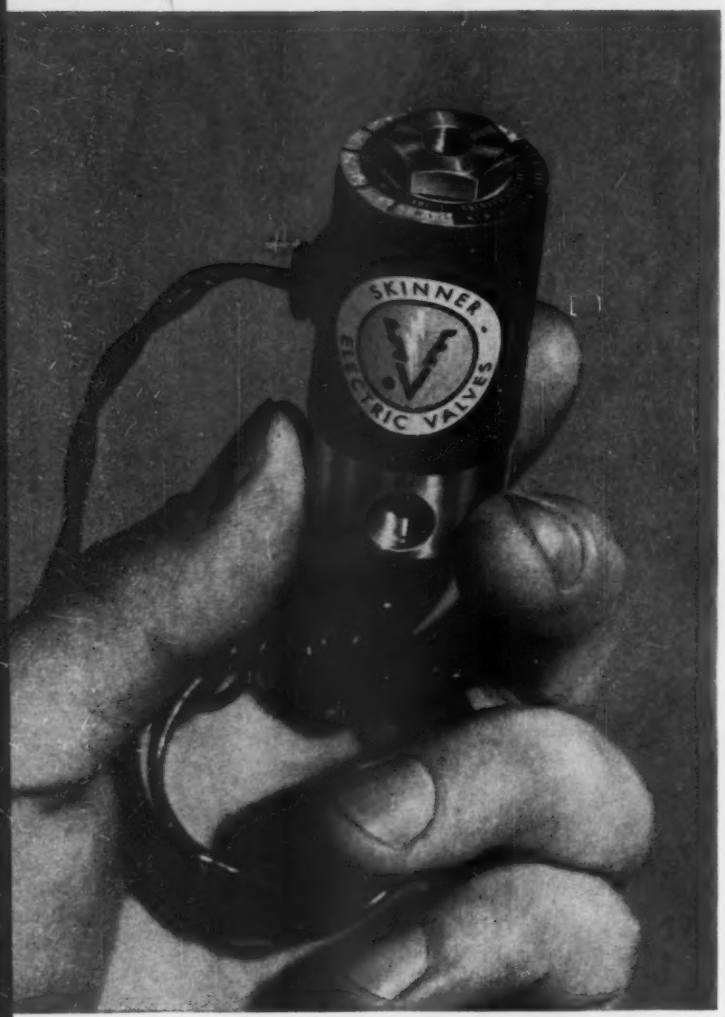
- Clear, transparent fluid
- Controls corrosion on work and machines
- All chemical. Does not support bacteria growth
- Unaffected by humidity
- Fire resistant
- Odorless

AMERICAN

AMERICAN OIL COMPANY
910 South Michigan Avenue
Chicago 80, Illinois

CIRCLE 302 READER SERVICE CARD

HOW REPUBLIC STAINLESS STEEL TRIMMED DEVELOPMENT COSTS OF A SUBMINIATURE SOLENOID VALVE



New Series B Solenoid Valves produced by Skinner Precision Industries, Inc., Electric Valve Division

Skinner Precision Industries, Inc., New Britain, Connecticut, selected Republic Type 430-F ENDURO® Stainless Steel for their new Series B Subminiature Solenoid Valve. The *consistent* quality of this stainless eliminated many of the usual problems associated with new product development.

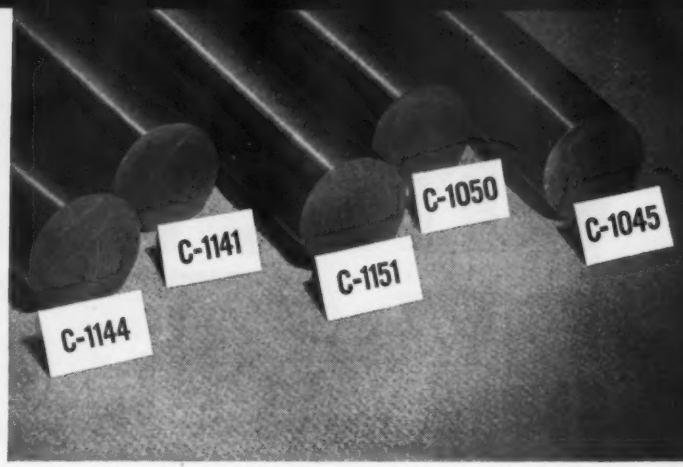
For valve body and operating parts, one-inch bars are formed, drilled, reamed, and tapped. Skinner reports excellent machining characteristics with low reject rate . . . high reliability with exceedingly low development costs.

The smallest solenoid valve currently available, Skinner's Series B measures 1″ in diameter by 2¼″ high. Weight is 5 ounces. Operating differential pressures range from a vacuum of 5 microns to pressures of 150 psi. Designed for use in hydraulic and pneumatic systems, valves must operate with all common media including semicorrosive fluids.

Republic is a new source for a complete line of precipitation hardenable stainless steels . . . a leading supplier of vacuum induction melted metals . . . the most experienced supplier of steels for cold extrusion . . . the largest producer of stainless and alloy steels. For information, contact your nearest Republic sales office or mail the coupon on the opposite page.

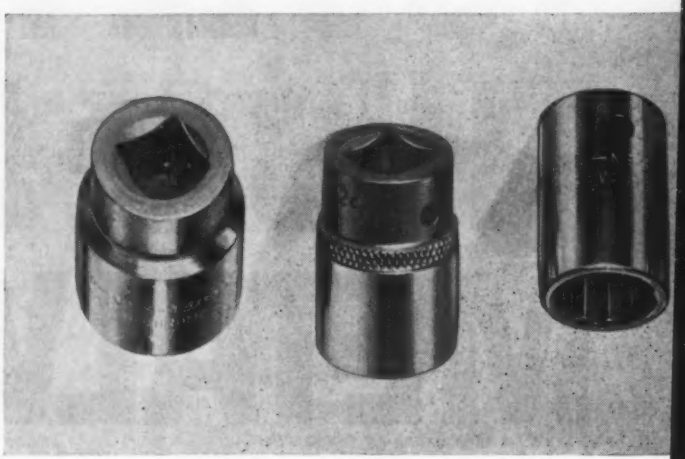
ENGINEERS: Send for a free copy of Republic's new booklet, *PRODUCTS FOR DESIGN ENGINEERS.* Helpful Stainless Selector Chart plus information on High Strength Steels, Titanium, Electrical Steels, Vacuum Arc Melted Steels, and other products. Mail the coupon.

SAVE IN MATERIAL AND MACHINING COSTS: Investigate Republic's CENTURY SERIES of high strength, stress relief annealed, cold finished steel bars. Each of the five grades gives you a minimum yield strength of 100,000 psi. Select the grade with the precise degree of machinability and toughness you need. Smooth, scale-free surfaces often require no finishing operations. Send for CENTURY SERIES Booklet by mailing coupon below.



STEEL FOR COLD EXTRUSION, supplied in heavier coils weighing up to 1600 pounds, is produced in Republic's new 11" Chicago bar mill. Atmosphere controlled continuous annealing furnaces can anneal, normalize, or spheroidize to your precise requirements. The cold extrusion process virtually eliminates raw material waste. Mail coupon for data.

ALLOY STEEL WRENCH SOCKETS are made by the Herbrand Division, Bingham-Herbrand Corporation, Fremont, Ohio. Uniform strength, toughness, and machinability of Republic Cold Finished Alloy Steel assure superior quality, minimum cost. Bars are formed, drilled, cut off in automatic screw machines, hot broached, heat treated, and chrome plated. Note the beautiful finish of these components.



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REPUBLIC HAS THE FEEL FOR MODERN STEEL

Strong, Modern, Dependable

CIRCLE 304 READER SERVICE CARD

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PRODUCTS FOR DESIGN ENGINEERS

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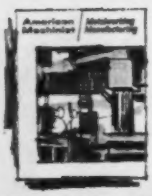
Company_____

Address_____

City_____ Zone____ State_____

CHECK READER BY MANUFACTURI MEN AND YOU'LL FIND THIS  IS METALWORKIN MOST POWERF SELLING TOOL

SHIP

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G'S

UL

In metalworking—men who matter read...

American Machinist / ***Metalworking Manufacturing***

A McGraw-Hill Publication, 330 West 42nd Street, New York 36, N. Y.

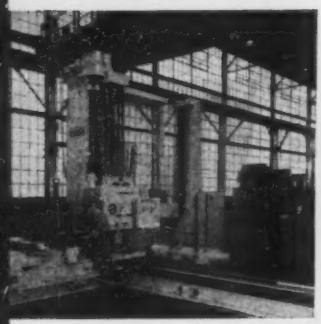
If you sell to metalworking, ask your customers to tell you which business publications they find most useful in their work—then advertise there. Twenty-five companies conducted such surveys on their own during the last 10 years—and American Machinist/Metalworking Manufacturing was consistently the winner . . . hands down!

Reason? AM/MM is the technical publication of metalworking—and metalworking is a highly technical industry.

AM/MM concentrates on how-to articles, case histories and *working* information on the often highly complex methods and procedures involved in manufacturing things from metal more efficiently, more profitably. In short, it's a 26-times-a-year work book. If metalworking is your market, it will work for you.

For up-to-date facts and figures on metalworking, ask your AM/MM *district manager for a copy of the 1960 Market Guide for Sales Executives.*

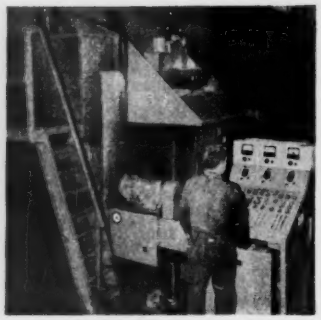
ANOTHER REASON TO SPECIFY **GENERAL ELECTRIC** NUMERICAL CONTROL



Cincinnati Gilbert Floor-type Horizontal Boring Mach., G-E Mark II NPC

Edlund Edlund-Matic (TM) Drilling and Tapping Machine, General Electric Mark II NPC

LeBlond Tape Turn Lathe, controlled by G-E Mark Century Numerical Contouring Control



Hill Beam Drilling Machine, General Electric Mark IV NPC

Moline Tube Sheet Drilling Machine, General Electric Mark II NPC

Fosdick Fosmatic Turret Drill with Automatic Depth Control, General Electric Mark II NPC

Brown & Sharpe Turr-E-Tape Six-spindle Turret Drilling Machine, G-E Mark II NPC

Wiedemann Turret Punch Press, General Electric Mark II NPC

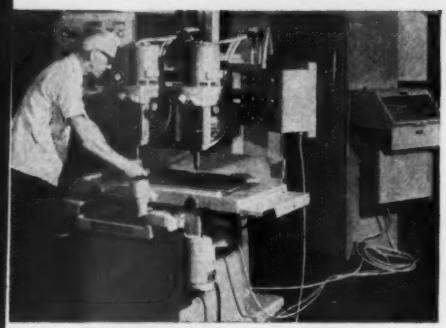
Selected by 50 machine-tool builders,

A double vote of confidence for General Electric's unmatched experience in designing, building, and applying numerical controls is evidenced by . . . the more than 50 builders who put them on the machines they sell . . . and, the over 500 American applications where they daily prove their outstanding performance on a variety of drilling, milling, punching, turning, and boring machines.

Many builders have used G-E automatic machine control since General Electric introduced electronic tracer control in 1943. Others selected G-E control based on the Company's pioneering work to develop the first magnetic tape contouring control in 1947. And many more turned to G.E. when the first building-block "packaged" positioning control—

NUMERICAL CONTROL
FOR AUTOMATION

American Tool Travelling 19-inch Column Openside Boring and Drilling Machine, General Electric Mark II NPC



Leland Gifford Two-head Printed Circuit Board Machine, General Electric Mark II Numerical Positioning Control

TODAY'S GENERAL ELECTRIC NUMERICAL CONTROL LINE features new Mark Century Numerical Positioning and Contouring Control (rear) and job-proved Mark Series Numerical Positioning Control for two to five motions (front).

proved in 500 metalworking applications

the Mark Series—was introduced in 1957. Its on-the-job record brought selection on 26 new machines exhibited at last year's Machine Tool Exposition.

And the current outlook is even brighter. New G-E Mark Century Numerical Control—utilizing solid-state circuitry—makes possible economical precision contouring with punched-tape input.

There are additional reasons to specify G-E numerical control: a full line to select from; nationwide service to minimize downtime; convenient time payment plan; and more that your machine tool builder or G-E Sales Engineer can tell you about. Or, write for descriptive bulletins to General Electric Company, Schenectady, New York. *Specialty Control Dept., Waynesboro, Virginia.* 795-13

Progress Is Our Most Important Product

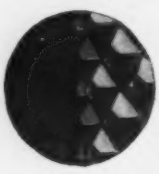
GENERAL ELECTRIC

CIRCLE 308 READER SERVICE CARD

set a new standard

Bay State has just completed a concentrated research and engineering program designed to make Bay State mounted wheels the finest available anywhere. Results are paying off for users in more uniform grinding action . . . easier operation . . . and virtually complete elimination of defective materials and workmanship. These wheels are as nearly perfect as the most advanced abrasive technology can make them.

POSITIVE WHEEL-TO-MANDREL BOND Deeply knurled mandrel ends and specially formulated bonding material weld wheel and mandrel into a single, rock-solid unit. Constant, rigid quality control tests are made to check this Bay State feature.

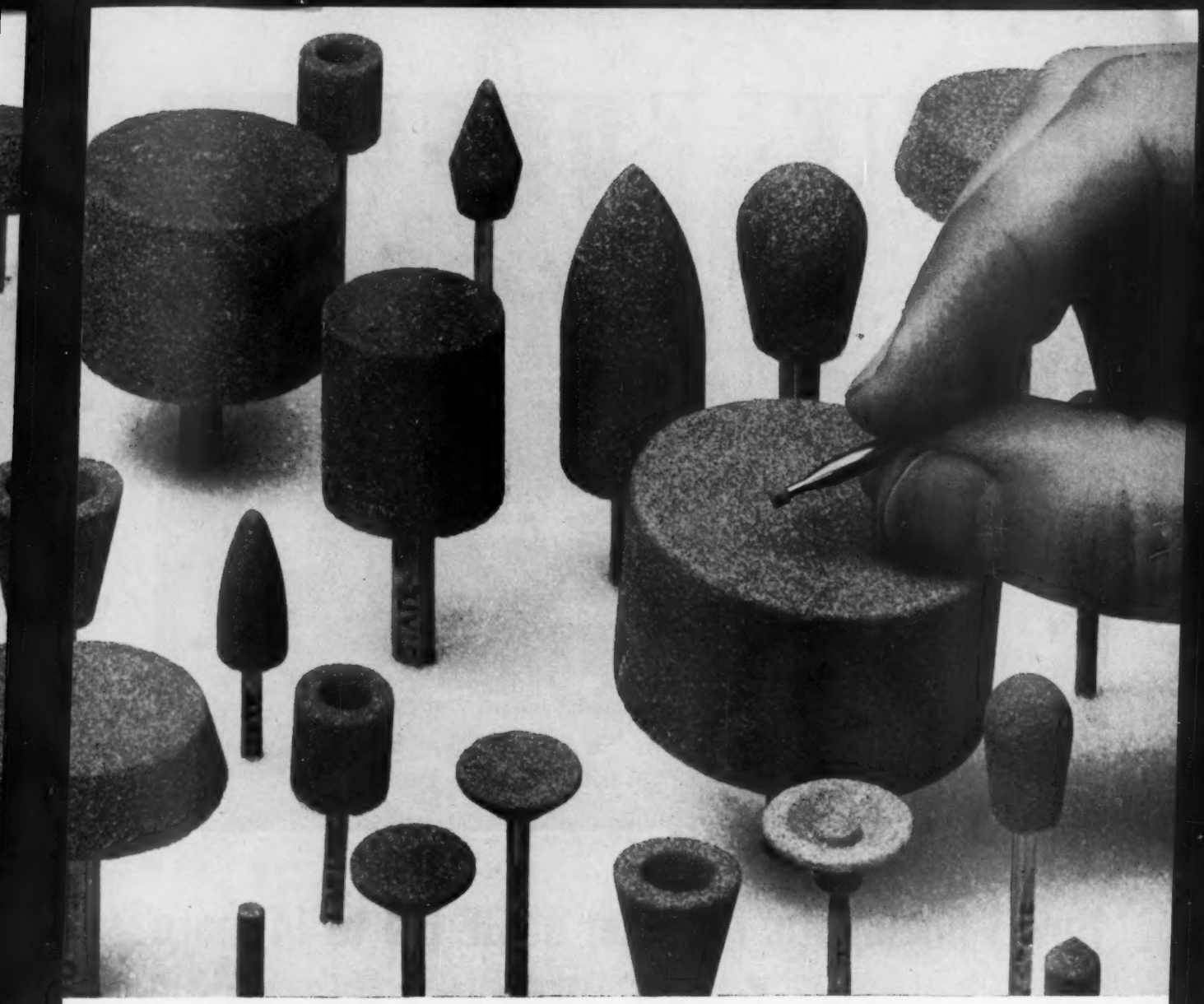


SUPER-ACCURATE CONCENTRICITY Every wheel is molded oversize and then *ground to shape on its own mandrel* so that it *automatically* becomes perfectly symmetrical and is perfectly concentric with the center of the mandrel itself. *Result:* Every wheel runs true from start to finish . . . no breaking in required . . . no hard spots, no soft spots, the whole wheel does a 100% job of grinding right down to the mandrel.

BAY STATE
WHEELS of PROGRESS

BAY STATE

CIRCLE 309 READER SERVICE CARD



# of excellence for the industry

MAXIMUM MANDREL UNIFORMITY Mandrel diameters are uniform to very close tolerances. No fumbling when operator changes wheels because new wheels can be locked into place with a minimum change in the collet or chuck setting.

COMPLETE INVENTORY IMMEDIATELY AVAILABLE Hundreds of different combinations of shape, grit, size, porosity, bond and mandrel size are in stock, ready to be shipped to users immediately. Bay State's 30-page catalog makes it simple to choose the specs you need for any job.

For special mounted wheels, call your Bay State, direct or distributor, representatives. They are abrasive specialists. *Better grinding at lower cost . . . that is their business.*

Bay State Abrasive Products Co.
Westboro, Mass.

Please send me the new Bay State Mounted Wheel catalog with full technical information on the best mounted wheels available to industry.

Company _____

Name _____

Address _____

City _____ *State* _____

ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

CIRCLE 310 READER SERVICE CARD

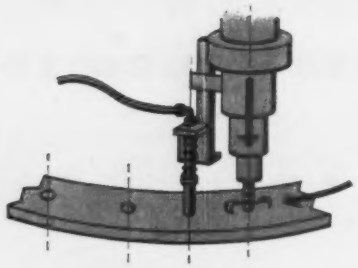
How 1 pneumatic recorder at GE led to 14 more

The first one did such a good job that General Electric's Evendale, Ohio, plant bought an additional 14 Sheffield pneumatic recorders, for application to automatic indexing jig borers.

An adjustable bracket on the quill holds a floating air spindle. After each hole is bored, the spindle enters the hole, automatically records the bore size. If the hole is within limits, the next hole is bored. If the diameter is not within specifications, the operator is warned by both lights and a buzzer.

The Sheffield Pneumatic Recorders proved so reliable that dimensions recorded at the machine have—in many cases—eliminated the need for subsequent inspections.

Write for Bulletin PREC.-212.



The SHEFFIELD Corporation Dayton 1, Ohio

A subsidiary of The Bendix Corporation

Inspection Gages, Dimensional Control Instruments, Machine Controls, Automatic Gaging & Assembly Systems, Measuray® X-Ray Thickness Measuring, Crushtrue® & Multiform® Grinders, Cavitron® Ultrasonic Machine Tools, Press-Pacer® Transfer Units, Large Dies, Tooling, Contract Manufacturing.

turn your obsolete or idle machine tools into dollar credit

By using the exclusive Pratt & Whitney Trade-in Plan

1. Contact Pratt & Whitney for a check-out of your old machine tools.
2. Whatever the makes or models of your old equipment, Pratt & Whitney will give you DOLLAR CREDIT towards the *present or future* purchase of any new Pratt & Whitney Machine Tool, Cutting Tool or Gage.

Here are the tremendous advantages of the exclusive Pratt & Whitney Trade-in Plan . . .

1. Your old machine tools are immediately removed from your plant.
2. You need *less cash outlay* for your new Pratt & Whitney equipment.
3. You pay no capital gains tax if you take dollar credit with Pratt & Whitney! (If, however, you make an *outright sale* of your old machine tools you *must* pay this capital gains tax.)
4. The entire transaction is handled by *one* reputable organization . . . no need to waste time in bothersome negotiations with several companies!

Contact your nearest Pratt & Whitney office now, to see how profitable this exclusive Trade-in Plan can be for your company. Or write, Paul Stanton, Vice-President, Marketing; Pratt & Whitney Co., Inc.; Charter Oak Blvd.; West Hartford 1, Connecticut. Phone: ADams 3-7561.

What Happens To The Used Machine Tools We Take In?
***Our* MACHINERY TRADING CORPORATION Sells Them At Attractive Prices**
See The Listing In This Issue On Page 287

PRATT & WHITNEY
A MAJOR INDUSTRIAL COMPONENT OF
FAIRBANKS WHITNEY

CIRCLE 312 READER SERVICE CARD

"We had 18-20 hours downtime every time we changed heats. With strip, we just hook on from heat to heat. No downtime."

"With strip we use smaller blanks to produce the same part."

"By using strip we save downtime, die repairs."

"Rejects have dropped from about 8% to less than 1%."

"We found we couldn't afford the low cost of sheet."

Read why Target Stamped Products, Inc., Kinsman, Ohio, switched from strip to sheet—and then back to strip. Comments are Harvey Haynman's, Target's president:

"We thought we'd give sheet a try back in 1958. The low cost looked too good to pass up. Today, you'd have a hard time finding a piece of cold rolled sheet around the shop.

"We were absorbing 18-20 hours of downtime every time we changed heats. With strip, we just hook on from heat to heat. The characteristics are the same from heat to heat and coil to coil. We don't waste time adjusting our dies.

"Strip saves us metal. We can use smaller blanks to produce the same part. I'd say we save from 1/16" to 3/32" of metal per part. That's a lot of steel when you're turning out 25-30 million parts a year.

"We don't have gauge problems now. The strip we buy is always rolled within our working tolerance. We work to a plus or minus .0025 inches.

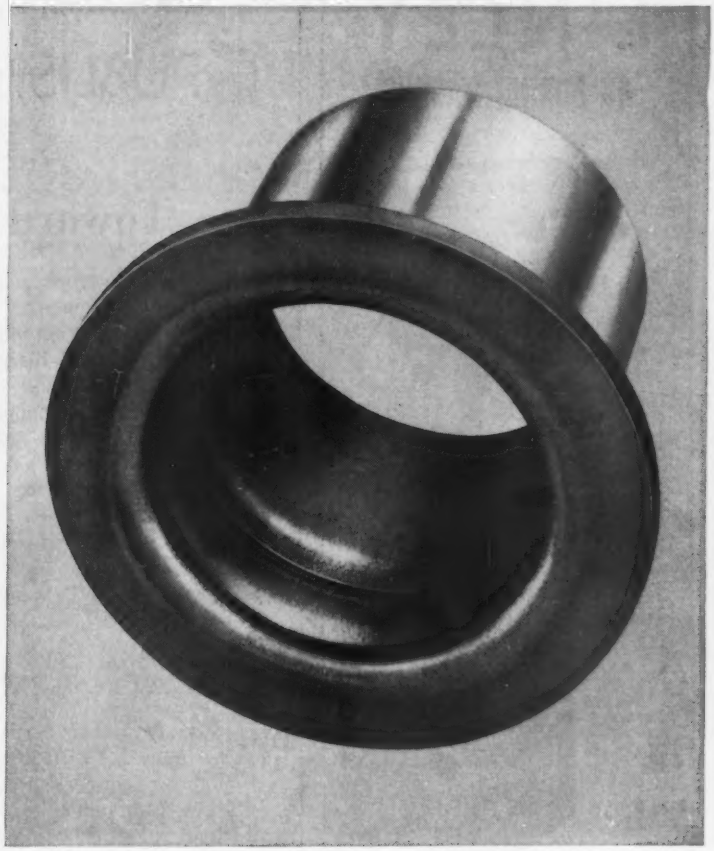
"So far, strip hasn't given us lamination troubles. It doesn't take much lamination to give you big trouble in a deep drawing operation. When the metal separates, part may stick to the punch while part stays in the cavity. As another blank transfers to the same station, there's a double smash and the die is ruined. That hasn't happened with strip. Saves a lot of downtime and die repair.

"Strip takes a deep draw without thinning out on you. Its uniform temper pays off when you're turning out Silent Blocks where both the ID and OD have to be right or the part's a reject.

"All in all our rejects have dropped from about 8% to less than 1% since we switched back to strip.

This mark tells you a product is made of modern, dependable Steel.

Outer metal bushing of a Silent Block. Target Stamped Products turns out millions of these each year for the auto industry. Silent Blocks are used in the suspension systems of all American cars—about eight to a car. To produce the piece, Target must work to a plus or minus .0025" tolerance or the Silent Block won't work. When Target switched back to strip, their rejects dropped from about 8% to less than 1%.



"You can have all the automation in the world, but if you're using the wrong steel, it just nickels and dimes you to death. With strip our machines keep working; we need less supervision, less tool repair. Our trim is small and our percentage of rejects is the smallest we've ever known. We found out we couldn't afford the low cost of sheet. That's why we're back with strip."

The switch is back to strip

Cold rolled sheet steel can be your best buy on a cost per pound basis. Certainly its quality has risen sharply since the war. But, pound cost is only part of the story. If you really need steel tailored to your specific production requirements, cold rolled strip is the answer.

Strip is not sold on an as-rolled basis. What you buy is a specific chemistry, temper, dimension, edge and finish to precisely meet your fabricating and end-use requirements.

American Steel and Wire has over 12,000 mill practices in available strip specifications. Many of your processing steps may actually be eliminated by using cold rolled strip.

Take a hard look at your production line and let our salesmen look with you. Check your rejects, your downtime, your scrap rate. Perhaps you can improve the quality of your product and cut production costs at the same time, with *tailored-to-the-job* cold rolled strip from American Steel and Wire. American Steel and Wire Division, Rockefeller Building, Cleveland 13, Ohio. USS and American are registered trademarks

American Steel and Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal and Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, New York, Distributors Abroad

New . . . Model 1A

LINLEY

JIG BORING MACHINE

Improved Accuracy For Precision Toolroom Work

The new Linley Jig Boring Machine has many features insuring greater accuracy that are usually found only on the higher priced machines. The entire table and saddle assembly has been greatly increased in size and weight for more rigidity and improved balance characteristics. Precise operation is assured through the use of square edged ways with positive no-shift table and saddle locks.

Table size and movement are 7" x 17½" and 6½" x 10" respectively. Guaranteed lead screw accuracy, one ten thousandths over entire range.

Send for full details, price.

LINLEY BROTHERS CO.
664 State Street Ext.
Bridgeport 1, Conn.

LETTER from the PUBLISHER

Toward Faster Reading

A letter from reader Horace Frommelt, consulting engineer, appearing in the "Letters" section of this issue, dramatically emphasizes the problem faced by today's manufacturer. Keeping up with the flood of developments in materials, methods and machines brought about by the technological revolution poses an almost insoluble problem. "To enjoy competitive health," says Mr. Frommelt, "a manufacturing facility must somehow find the correlation between what is being made available through this scientific and research upheaval and what can and must be adopted, adapted and embraced." He goes on to say, ". . . the vast majority of the plants cannot—at least do not—take the time from invoicable productive manhours to uncover these inventions."

You are an exception . . .

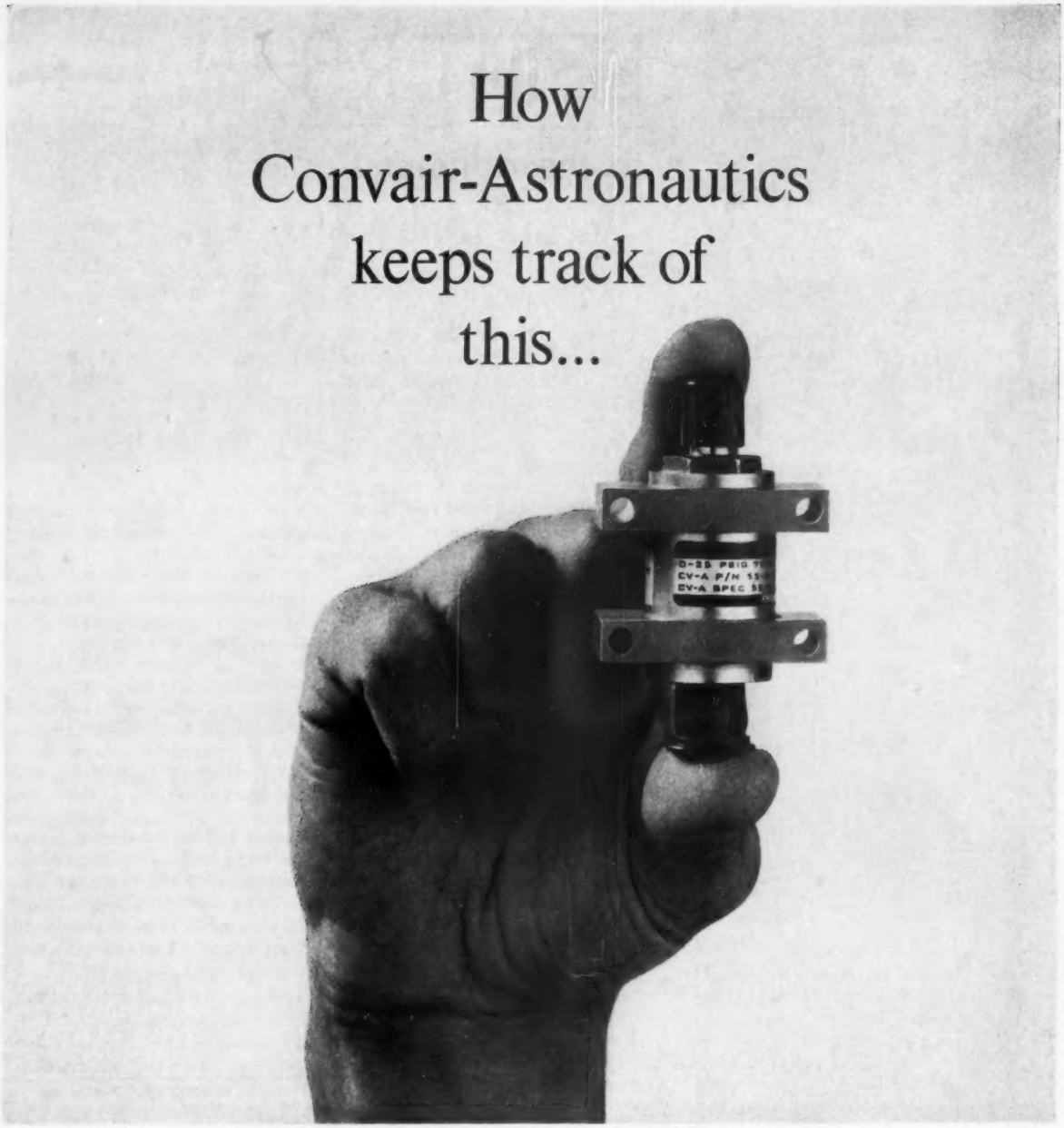
Because as a reader of AMERICAN MACHINIST/METALWORKING MANUFACTURING you *do* take the time to seek out, examine and evaluate new developments in metalworking technology that can be applied in your own manufacturing operation, you are an exception to Mr. Frommelt's rule; you, and 45,000 other subscribers to *AM/MM*. Yet even you must have asked yourself on occasion: "How can I stay on top of this torrent of information?" Like other busy men you have to cope with that most demanding of bosses, time.

Information quickly, easily . . .

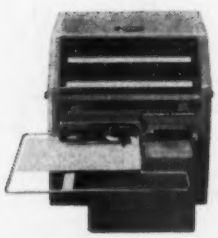
AM/MM is designed to help save you time. Take a look at page one of this issue. It gives a fast rundown of what this issue offers, enables you to determine quickly what is of interest and what is not. Note how "Metalworking Report" and the "Trends" pages are written: a concise, fast-moving style to give you the idea quickly. Each major article has a summary or introductory paragraph in boldface type to tell you what the article is about, help you decide whether to take the time to read it. And if you'd like to review the articles that have appeared during the last year, we publish an *annual index* of editorial material classified by subject matter. Drop me a note if you'd like a copy.

George Reppert

How Convair-Astronautics keeps track of this...



(and 84,999 other missile parts)



The Manufacturing Control Department at Convair (Astronautics) Division of General Dynamics Corporation has a monumental problem: how to keep track of the movement of over 85,000 individual missile parts.

The solution: *automated data preparation* by means of a Friden Collectadata® system. Situated in key plant locations, Collectadata transmitters report virtually all parts movements—over 5000 every day—to central Collectadata receivers which record them into punched paper tape. At day's end the Collectadata tapes are fed into the electronic computer at Astronautics for further data processing.

This is what Astronautics says: *"The Collectadata has been in use at Astronautics for less than a year. But by eliminating tedious manual paperwork, and by assuring prompt processing of all inventory reports, it has already saved considerable time, trouble and money."*

How much could Collectadata save you? Call your Friden Systems Man, or write: Friden, Inc., San Leandro, Calif.

THIS IS PRACTIMATION: automation so hand-in-hand with practicality there can be no other word for it.

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Friden

Save time and money day in and day out. With a Minute Man Keyway Broach you can cut a keyway by hand, in an arbor press, **in one minute** for **as little as one cent.** Available individually or in kits complete with broaches, bushings, shims and keystock. For keyways from 1/16" to 1" in any bore ¼" to 3".

SAVINGS WITH STANDARD SQUARE BROACHES, TOO.

For finishing ⅛" to 1" square holes in one pass in cast or drilled bore. (32nd size, too)

The duMont Corp., Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST A describing Square, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

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CIRCLE 317 READER SERVICE CARD

LETTERS

to the editors

330 W 42nd St, New York 36, NY

Let's Get to Work

Dear Sirs:

Your editorial, "The Sooner The Better" (*AM/MM*—June 26 '61, p65), was extremely interesting to me. I have recently returned from three weeks in England, Germany, and Switzerland, and I know what you say is true.

While in Germany I visited several plants, all far ahead of anything competitive in America, in equipment and productive labor. Russia will be still more modern and equipped with later improvements.

Unless we have a rebirth of honest and inspired Americans—a moral rearmament and dedication to higher standards of conduct—we are going to be overwhelmed by Mr Krushchev and his planners, who mean to avoid a shooting war and let us destroy ourselves while chasing the Almighty Dollar—and the hell with the other fellow.

What we need most is an organization of fearless, dedicated, and honest men who will make their voices heard by the government, by the public, and by the whole world. They could spearhead a new, truly dedicated AMERICAN SPIRIT for preservation of our way of life—the right to pursue the happiness of free men under liberty.

Gilbert L Dannehower, *president*
High Precision Products Co
Westfield, NJ

The Need to Read

Dear Sirs:

Your "Letter from the Publisher" entitled "The Man Who Reads," (*AM/MM*—June 26 '61, p42) emphasizes one of industry's most vexing and critical current problems. It is so pointed and pertinent that I cannot resist both a word of commendation and, if permissible, a suggestion.

The technological revolution, perhaps the most violent revolution any industrial age has faced, daily spawns a flood of developments in materials, methods, and machines. To enjoy competitive health and well-being, a manufacturing facility must somehow find the correlation between what is being made available through this scientific and research upheaval and what can and must

SHOPMATES

N. Jarvis

"UH... I WAS THINKIN'... UH ... THESE PINS ARE ... UH... KINDA' WEAK... MAYBE WE OUGHT TO BEEF UP THE SHANKS... PLENTY OF ROOM FOR BIGGER SHANKS ON THE PINS...
SINCE WHEN IS HE AN AUTHORITY ON PIN SIZES??
"... SINCE HE BORED THE PIN HOLES OVERSIZE!
N. JARVIS

with this NEW Cadillac Bore Set PLA-CHEK

You can set:

DIAL BORE GAGES
INSIDE MICROMETERS
TELESCOPING GAGES
INTERNAL CYLINDER GAGES

. . . much faster than you can read this page!

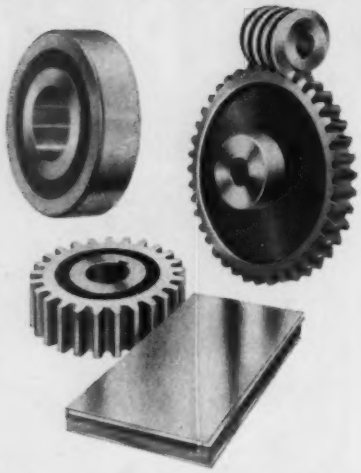
It's true! Time-saving is one of the big features of this new Cadillac Bore Set PLA-CHEK. Guaranteed accuracy is another! Designed especially to save time, money and to provide extreme accuracy in the setting and checking of Dial Bore Gages, Inside Micrometers, Telescoping Gages and Internal Cylinder Gages, this new PLA-CHEK is guaranteed to .000050". No gage blocks need be used and, in most cases, ring gage setting masters are not necessary. This new PLA-CHEK is the result of over 16 years' experience in the building of high-precision PLA-CHEK Gages. It is designed for easy portability on the job so that it may be used either on the surface plate or at the machine. Write, wire or telephone TODAY for prices and additional information.

Use it as a regular PLA-CHEK, too!

Cadillac GAGE COMPANY

P.O. BOX 3806 • DETROIT 5, MICHIGAN

VALVOLINE
Tectyl
KEEPS METAL SURFACES FREE FROM RUST



There's a job for Valvoline Tectyl in your industry, protecting metal surfaces against rust and corrosion during shipping and storage.

Low-cost Tectyl rust preventives are widely used by the military services and by industry.

Tectyl's easy-to-apply, easy-to-remove film provides complete protection from the effects of snow, rain, perspiration, humidity, salt air, and corrosive fumes.

There is a Tectyl product for every need, with more than 40 variations of three principal types: oil-type, solvent cut-back and hot dip. Brush on, spray on or immerse. *We suggest you write today for your copies of two helpful, detailed Tectyl charts which give industrial and government specifications and applications.*

VALVOLINE
Tectyl RUST PREVENTIVES
VALVOLINE OIL COMPANY
A Subsidiary of Ashland Oil & Refining Company
Branch Offices — Principal Cities

be adopted, adapted, and embraced.

My fifty years of experience tells me just one thing: the vast majority of the plants cannot—at least do not—take the time from invoicable productive manhours to uncover these inventions. Only a few are equipped to comb systematically through such an invaluable source as *AM/MM*.

AM/MM has done a most commendable job by gathering together in its "Metalworking Report" and in its "Trends" pages the departmentalized, tagged, and coded nuggets of information designed to save the busy productionist's time. I believe it can do more—somehow more must be done if the full advantage of *AM/MM* is to be made availabe to this topsy-turvy industrial world of ours.

And so what follows is not criticism but, mayhap, constructive suggestion: Make available a microfilm of each issue along with tape recordings not only of editorial highlights but advertising revelations also. These tape recordings would act as a memory storage and hence a quick and easy way to facilitate information retrieval.

Thanks for the excellent job you are doing! But as good as you are, you have the setup to be even better.

Horace Frommelt, *director*
Manufacturing Research Center
Ferro Powdered Metals Inc
Salem, Ind

At the moment, we have no plans for microfilming and tape recording the issues of AM/MM. However, we are always interested in any idea that might put the important metalworking developments before our readers as efficiently as possible. See "Letter from the Publisher," p70—Ed.

AM/MM

"We must have a rule against barbequed lunches."

CALENDAR

Society of Automotive Engineers—Farm, Construction, and Industrial Machinery Meeting, Sept 11-15, Milwaukee Auditorium, Milwaukee, Wis.

Instrument Society of America—Annual Meeting and Automation Exhibit, Sept 11-15, Memorial Sports Arena, Los Angeles, Calif.

Pressed Metal Institute—Annual Meeting, Sept 24-28, Grand Hotel, Point Clear, Ala.

American Welding Society—National Fall Meeting, Sept 25-28, Adolphus Hotel, Dallas, Texas.

American Die Casting Institute—Annual Meeting, Sept 27-28, Edgewater Beach Hotel, Chicago, Ill.

American Production & Inventory Control Society — National Technical Conference & Exhibit, Sept 28-29, Pick-Congress Hotel, Chicago, Ill.

American Machine Tool Distributors Association—Annual Meeting, Oct 4-6, Penn Sheraton Hotel, Pittsburgh, Pa.

Society of Automotive Engineers—National Aeronautic Meeting and Display, Oct 9-13, The Ambassador, Los Angeles, Calif.

American Standards Association — National Conference on Standards, Oct 10-12, Rice Hotel, Houston, Texas.

Magnesium Association — Annual Convention, Oct 16-18, Belmont Plaza Hotel, New York, N.Y.

National Safety Council — National Safety Congress, Oct 16-20, Chicago, Ill.

American Institute of Mining, Metallurgical & Petroleum Engineers — Metallurgical Society Fall Meeting, Oct 23-26, Pick-Fort Selby Hotel, Detroit, Mich.

American Society for Metals — National Metal Exposition and Congress, Oct 23-27, Cobo Hall, Detroit, Mich.

Society for Nondestructive Testing — Annual Convention, Oct 23-27, Henrose Hotel, Detroit, Mich.

A super-finish saw so tough it can't scratch itself.

NEW

Brown & Sharpe

Sawperior

GREATEST ADVANCE IN SLITTING SAWS IN 50 YEARS!

The mirror-like finish of new B&S "Sawperior" slitting saws mark 3 new developments that more than double production and make other saws virtually obsolete!

NEW Alloy High Speed Steel for Longer Life.

NEW Tooth Design for Fast Free Cutting!

NEW Super-Finish prevents Chips Seizing and Galling!

PRODUCTION BENEFITS

Shop tests prove the new tooth geometry and mirror-like finish give up to 4 times as much slitting production between sharpenings.

Super finish on sides permits use of less concavity or side clearance thereby providing a stronger saw section and a stiffer, more accurate saw.

Smooth side finish resists scratching, resists corrosive action of coolants and rust.

New saw design requires less milling machine power thereby allowing heavier cuts without strain or chatter.

New saw geometry and super finish sides give smoother surface finish in cut.

Send for B&S Cutting Tool Condensalog . . .

For that EXTRA Edge in Production!

Brown & Sharpe

Cutting Tool Division
Brown & Sharpe Mfg. Co.
Providence 1, Rhode Island

NOW 3-AXIS NUMERICAL CONTROLS FOR B&S TURRET DRILLS

HUGHES 3-AXIS NUMERICAL CONTROLS are now available as original equipment on Brown & Sharpe turret drills. With 3-Axis control, operation is completely automated—more work at less cost. Each spindle can be programmed for multiple drill depths. Feed speeds are tape controlled. Set-up time is reduced more than sixty per cent. And—as with all Hughes Numerical Controls—jigs, fixtures and templates are eliminated. Fitting 3-Axis controls to B & S turret drills is another "first" for Hughes. And you get proven reliability through Hughes' long experience in numerical controls. Hughes' transistorized circuitry, modular construction, and photo-electric tape readers mean more "up-time," increased production and less maintenance. Hughes ULTRA-RELIABILITY adds up where it counts—in your profits.

SPECIFICATION SUMMARY

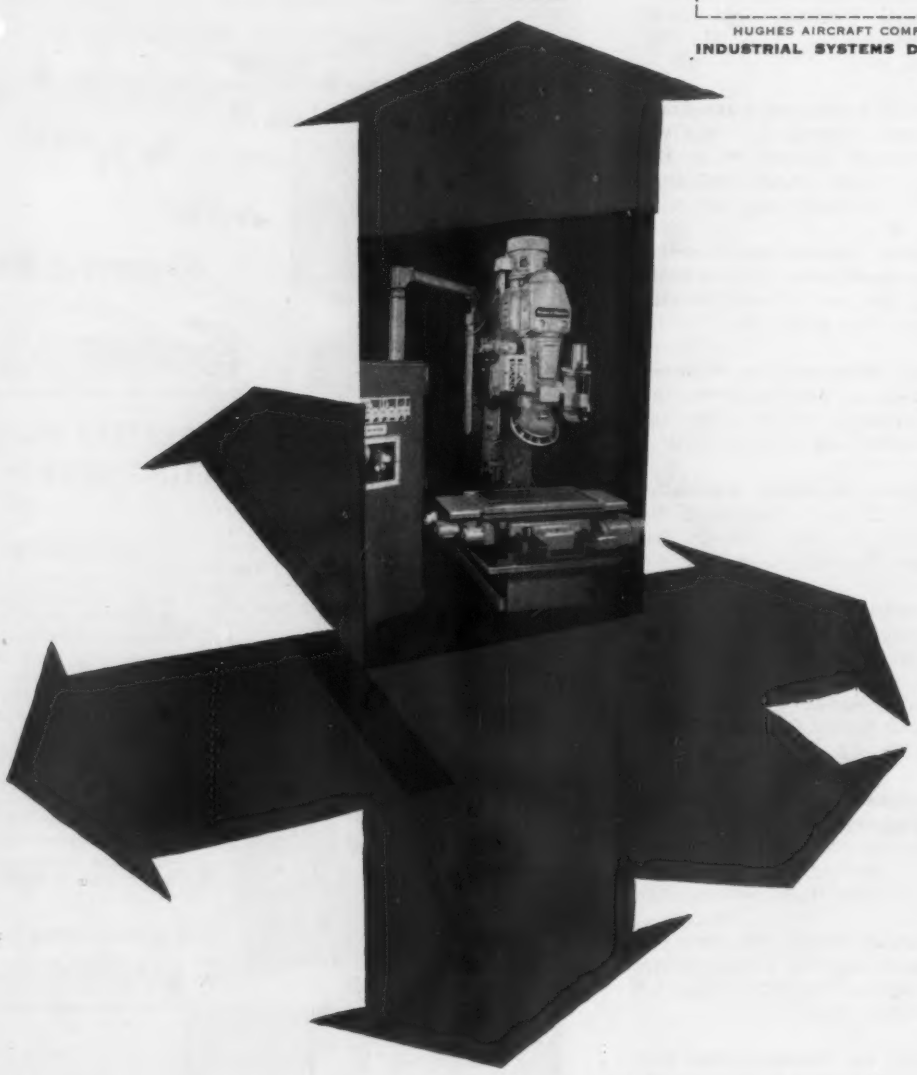
Axis controlled	X	Y	Z
Range of movement	20"	15"	9"
Accuracy	±0.001/ft.	±0.001/ft.	±0.002/ft.
Repeatability	±0.0002/ft.	±0.0002/ft.	±0.001/ft.
Position Speed (in./min.)	160"	160"	180"

Find out more about 3-Axis (or 2-Axis) Hughes Numerical Controls. Ask your B&S distributor, or write, wire, teletype (TWX INGL 4117) or call: Hughes Industrial Control Systems, Dept. No. 92-21, P.O. Box 90904, Los Angeles 45, California.

Creating a new world with electronics

HUGHES

HUGHES AIRCRAFT COMPANY
INDUSTRIAL SYSTEMS DIVISION



SPOT NEWS...

- **Numerically controlled inspection machine for parts up to 60x96x30 in.** will be built by Norden Division of United Aircraft for the Norair Division of Northrop Corp. Machine, expected to be in operation early next year, will provide a print-out of errors in the part inspected.

- **Only 52% of metalworking equipment in Chile is ten years old or older,** contrasted to 62% in the United States, according to an inventory (similar to AM/MM's Inventory) now being completed by the Chilean Steel Institute. Most of the younger-age equipment consists of general-purpose tools of postwar design and the effective age is higher than the figures indicate. High-precision and special machines are scarce.

- **Machine tools, production equipment and materials worth some $276 million** are to be sold as surplus over the next ten months in the Washington, DC, area. About $150 million worth is at the Naval Weapons Plant; the rest is government-owned equipment at the Martin Co plant near Baltimore. Full information is available from the Small Business Administration, 608 13th St, NW, Washington 25, DC.

- **Oliver Instrument's new electrolytic face-mill grinder,** reportedly the first such machine in the industry, can, in most cases, grind a brazed or clamped carbide insert in one pass because it takes a deep, skiving cut across the toolbit edge. Depth of grind with the diamond wheel is 0.010 to 0.015 in. per pass; time is 30 to 45 seconds per tooth. Machine uses an Anocut power pack and features automatic hydraulic clamping.

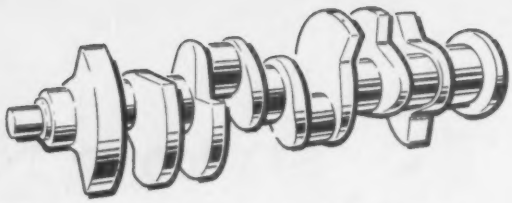
- **Lockheed-Georgia is said to be the first target of the Teamsters Union** in its efforts to move in on large defense plants. The Hoffa union got its foot in the door with a meeting early this month of 125 representatives of production departments who reportedly invited the Teamsters to move in. However, in order to get an NLRB election against the International Association of Machinists for control of Lockheed-Georgia, the Teamsters will have to get the okay of 30% of the division's 5000 union members. IAM's contract is good until July, 1962, so no change can take place before then.

- **Largest radial-draw-forming machine ever built by Cyril Bath Co** (Solon, Ohio) will be installed at General Dynamics-Fort Worth. Installed, with tooling, it will cost well over $1 million and weigh about 300 tons. Machine, which will form major frame and skin elements, is the fourth radial draw-former ordered this year as part of the Air Force's modernization program.

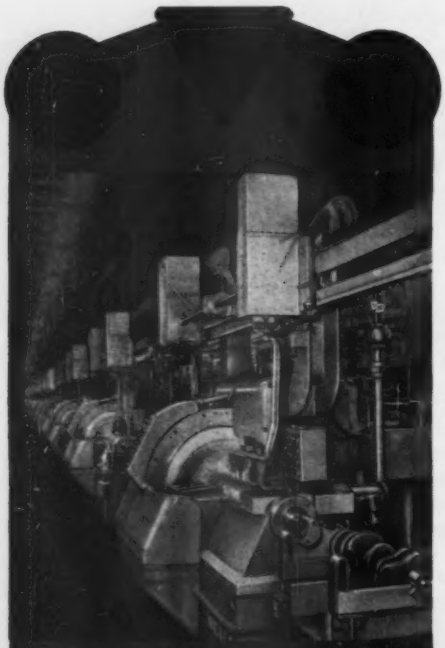
- **Foamed aluminum, a new material that floats and is 12 times lighter** than solid aluminum, has been developed by Dynamic Metals, Inc, Houston, Texas. Present commercial production is concentrated in the building and decorative fields (acoustical tile, room dividers). Chemicals mixed with molten aluminum produce the foam; density can be adjusted by controlling the amount of trapped gas bubbles. It can be sawed, machined, nailed, or glued.

- **Pentagon has accelerated M-60 tank production** at Army Ordnance's Detroit Tank Arsenal. New schedule at the Chrysler-operated plant calls for 100 tanks a month, beginning in 90 days. Present rate of 75 tanks a month had been scheduled to drop to 60 a month in December. Total run stays at 660 vehicles.

- **450-ft-long, $1-million metal-coating line at Pre-Finish Metals Inc,** Elk Grove Village, Ill, can double-coat coil stock up to 48 in. wide. Seven-stage cleaning and processing operation assures positive coating adhesion and continuity. Line can also single-coat coil stock and handle steel sheet from 18 to 60 in. wide and 4 to 12 feet long. Initial output of 350 ton daily can easily be exceeded, according to company officials.



COST-CUTTING EFFICIENCY!



The versatility of the WICKES CH-4 Center Drive Lathe is illustrated in this view of a fully-automated multiple installation. Lathes are equipped with automatic loaders and unloaders, automatic power chucks, hydraulically operated headstock and tailstock, live centers, central coolant system, chip disposal through bed, pre-set tool bits and solid rear cross slides.

world's only specialist in
CRANKSHAFT TURNING

WICKES
MACHINE TOOL

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SAGINAW, MICHIGAN
PHONE PLeasant 7-0411

PROVEN IN PRODUCTION . . . AND IN STEEL . . . WITH WICKES CENTER DRIVE CRANKSHAFT LATHES

VERSATILITY TO MATCH YOUR MOST CRITICAL JOB REQUIREMENTS—proven in steel by WICKES-created Center Drive Lathes, the only complete line of Center Drive Crankshaft Lathes built in the world. Here's a versatile line of rugged, maintenance-free lathes designed to efficiently turn the main line bearings and ends of a wide range of forged or cast crankshafts to tolerances that eliminate the need for any finish turning slides. Does the job on either a high or low production line.

WICKES Center Drive Lathes, with all tooling mounted on heavy cross slides, cut your tooling costs. Down time is reduced with mounting plates that allow quick change-over of all tooling from one crankshaft to another. Center Drive Crankshaft Lathes—pioneered by WICKESmanship—let you profit *before* production, with cost-cutting versatility—proven in steel and on the job.

WICKESmanship developed the world's first center drive crankshaft lathe and builds all of the specialized variations . . . CH-2, CH-4, CH-8, and CH-10, with 2, 3, and 4 slides . . . all available in this production proven series, and all giving consistent conformance to rigid tolerances, as demanded by the most exacting crankshaft manufacturers.

division of the
WICKES corporation

WASHINGTON...

No tool-up for defense expansion . . .

Pentagon officials say there will be no major tooling-up to meet the Kennedy Administration's new military buildup. The latest plans call for an increase of only $1.7-billion worth of hardware procurement.

For the most part, these are off-the-shelf items already in production—trucks, trailers, fighter planes, combat vehicles, tactical missiles, and the like—rather than new prototypes which would require a substantial tooling-up for quantity production.

The Defense Department policy will be to order multiple-shift operations (very few defense producers are now on three shifts) rather than add tooling and new facilities for other contractors.

It is conceivable, Defense officials say, that in a few isolated cases contractors will need additional production equipment to handle the new military orders (Lockheed, Marietta, Ga, for instance, which builds the C-130 transport). But these will be exceptions.

No controls in sight . . .

Washington is sure that the $3.5-billion military buildup will be easily absorbed by industry without a pinch. The word is that, barring fighting or "unreasonable" scare buying, there will be no call for any kind of materials controls, labor controls, or wage-price controls. Plans being given publicity are just that—plans. Government officials continuously reshuffle papers, updating phantom controls that jibe better with changing military and economic conditions.

Tax credit still alive . . .

The administration still hopes to get a tax bill from Congress before it adjourns, including the tax credit for purchases of industrial machinery and equipment.

The President's Berlin mobilization speech confused the situation, since he promised to ask for tax increases next January if he found them necessary to balance the budget, including the extra defense spending Congress is approving.

Now, however, Treasury Secretary Dillon has told Congress that the fiscal 1963 budget can be balanced without raising taxes—assuming that there is no new crisis that would require another boost in our defense buildup.

Hence, the administration considers the investment credit "essential" to our long-term economic growth and to the strengthening of our competitive position in world markets.

The question now is whether Congress will stay in session long enough. Tax legislation of this kind—a $1.1-billion proposed tax cut to be offset by about that much in tax increases—won't be handled hurriedly by Senator Byrd, chairman of the Senate Finance Committee.

New tax-haven approach . . .

A new tack has been taken by the Treasury in its attempt to tax currently the profits earned by US subsidiaries in so-called tax-haven countries. Ways and Means Committee has refused to consider any changes as part of this year's tax bill. The Committee instead asked Treasury to come up with specific language which it could study until next year, when it may take up the subject again.

Treasury now proposes to require U S parent corporations to include in current income the earnings of subsidiaries from seven different kinds of "tax haven transactions"—income derived from sales, commissions, royalties, and the like outside the country in which the subsidiary is located.

Manufacturing subsidiaries would be exempt. But most of the trading corporations in Switzerland and other low-tax countries would be caught in the new Treasury net.

Export-Import Bank loans . . .

Ex-Im loans sought by foreign subsidiaries of U S corporations are being turned down. The bank instead suggests that it would approve requests for help on the same transaction if the application comes from the parent corporation. The new Ex-Im policy came to light when a Venezuelan subsidiary of A O Smith, Milwaukee manufacturer, was turned down on a $60,000 sale to a Peruvian customer.

Curbs on defense advertising . . .

Congress has come up with a compromise policy on advertising by defense contractors (*AM/MM* —Jul 24 '61, p79). Advertising by contractors will continue to be allowed so long as expenses come out of a company's own profits. But contractors will be allowed to charge the military the costs only for help-wanted advertising, ads for "procurement of scarce items" and the disposal of scrap or surplus materials involved in the defense project. Institutional advertising in technical journals will no longer be considered a cost-reimburseable expense.

BULLARD REVERSES THE PRICE TREND

with the *NEW* Lower Priced . . .

MULT-AU-MATIC, Type "M"

with these features:

NEW Simplified Control
NEW Angular Carrier Chip Guards
NEW Larger Chip Capacity
NEW Index Registry
NEW American Standard Spindle Nose
NEW Double Coolant Seal on Spindles
NEW Design Heavy Duty Clutch and Brake – No Adjustment
NEW Adjustable Power Chucking
NEW Lubrication Filter System
NEW Standard Tooling

All Bearings and Gears are pressure lubricated

Easy to Service and Maintain

Minimum Floor Space

Versatility For Quick Set Up

Uses American Standard Chucks

Maximum Efficiency

Call your nearest Bullard Sales Office or Distributor, for complete information or write

The Bullard Company
Bridgeport 9, Connecticut

DETROIT...

Car assembly in high gear . . .

Automakers are hitting as crackling a pace as they dare right now, building up the rate of car assembly as high as possible without running into severe problems. Object is to fill dealer inventories by the '62 introduction dates.

Problem is to solve the minor and inevitable hitches along the assembly lines as they crop up. By now most of the expensive components such as engines and transmissions, as well as new sheet-metal panels, are stacked up fairly well, in preparation for normal parts flow.

July production was low for all the major nameplates, because of slowdowns for changeover and because of caution about overstocking the dealers with '61 models. The production pattern through late spring and early summer was generally up, and in some cases sharply up, as sales rose from the depths of the slump.

Prospects for the fall are good, based on production curves, and expectations are high. Ford and Chevrolet, with completely filled-out lines ranging from compacts to luxury big models, are in the best potential positions they have managed in years.

The presumably unfulfilled market (because of the recent slump) should also be healthy for other car models, too.

Better cast-iron engines . . .

A new generation of cast-iron engines has been emerging from the Detroit casting industry, based on much improved foundry practice and more knowledgeable engineering. You couldn't call it a revolution in iron casting, but it does represent a significant refinement in mass-production foundry operations, resulting in lighter, better engineered, and less expensive engines.

The trend started with the 144-cu-in. Falcon Six, introduced in fall of 1959, continues with the new Ford light V-8 for the '62 medium-size compacts, and has been bolstered by similar developments at General Motors, which is bringing out a light, efficient 4- and/or 6-cylinder cast-iron engine for the new Chevy compact and a CI V-6 for the Buick compact Special.

Nobody in the industry wants to scrap a fairly recent engine design, but any forthcoming new cast-iron engines will also incorporate thin walls (where practical) and a minimum of excess weight. These requirements may also mean new melting and casting equipment in some plants, also an early engineering overhaul of some existing cast-iron engines of elderly vintage.

The new-generation CI engines are cast with precision cores, the best possible molds, and metal held more critically to an exact temperature that allows it to flow into thin mold cavities without chilling.

Contour designs take into account not only engine-operating stresses imposed by the burning fuel, but machining stresses developed when the required flat and curved surfaces are produced by cutting tools.

Less metal wasted . . .

Although there is little difference in the sizes and shapes of major bearing areas and strengthening ribs, the thin cast walls that require little strength (such as water-jacket surfaces) are being refined to waste as little metal as possible. Along with these refinements, which save the automakers money because less material is required, goes better, more detailed engineering concerned with internal stresses, twisting moments, and vibrational effects.

What about aluminum engines?

The aluminum side of the contest didn't get much aid from GM's recent experience with its semi-permanent-molded aluminum V-8. It performs beautifully, but costs entirely too much in production.

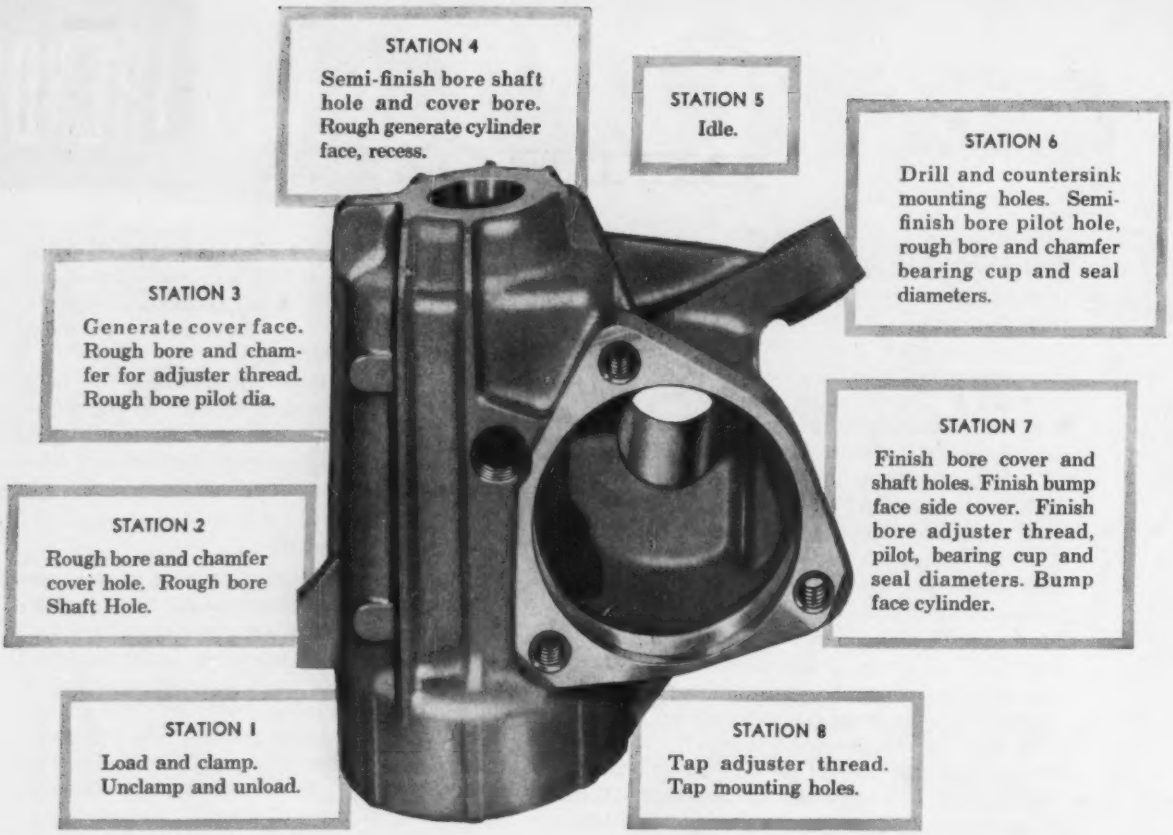
GM likes aluminum because it is potentially less expensive than cast iron, and is now working on a new design for a die-cast aluminum engine. GM may yet be first into production with a die-cast engine designed entirely as a die-casting.

Rambler's inline-6, in production at Doehler-Jarvis, was originally designed as a cast-iron engine, then modified somewhat to make it die-castable. D-J is now working on a new engine design, planned from the start as a die-cast aluminum block, which may appear in a 1963 model Rambler.

This is a V-type engine, probably a six. Because it was planned from inception as a die-casting, it will cost less than the present inline-6.

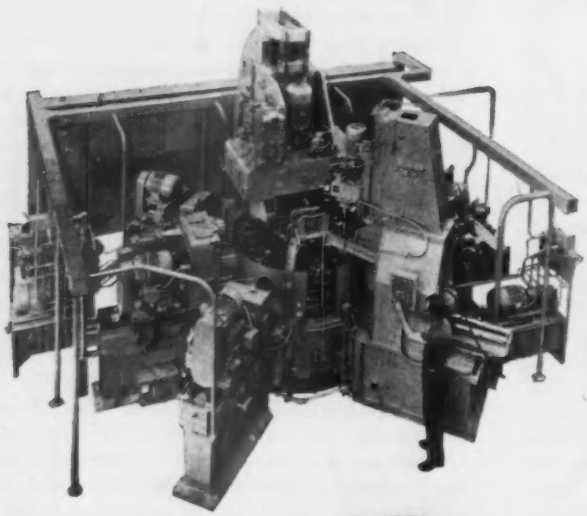
One stumbling block is the engine head. A new head design for the Rambler inline-6 was developed and just about approved for production for the 1962 models, when the resin bond that joined the two halves of the split head failed in hot water test—after exposure for six months.

To date the bonding problem is unsolved. So far, bonding seems to be the only way to make a low-cost, die-cast aluminum engine-head work, because a one-piece head cannot be economically die-cast.


STATION 4
Semi-finish bore shaft hole and cover bore. Rough generate cylinder face, recess.
STATION 5
Idle.
STATION 6
Drill and countersink mounting holes. Semi-finish bore pilot hole, rough bore and chamfer bearing cup and seal diameters.
STATION 3
Generate cover face. Rough bore and chamfer for adjuster thread. Rough bore pilot dia.
STATION 7
Finish bore cover and shaft holes. Finish bump face side cover. Finish bore adjuster thread, pilot, bearing cup and seal diameters. Bump face cylinder.
STATION 2
Rough bore and chamfer cover hole. Rough bore Shaft Hole.
STATION 1
Load and clamp. Unclamp and unload.
STATION 8
Tap adjuster thread. Tap mounting holes.

153 Aluminum Steering Gear Housings per hour

automatically processed on this GREENLEE Machine



This Greenlee 8-Station Horizontal and Vertical Spindle Machine is establishing some excellent performance records for a leading automotive manufacturer. The 52 inch table carries 8 work fixtures. Each has power clamping. To insure rigidity and accuracy, the table is clamped hydraulically metal to metal. Indexing is fully automatic. Cycle time is 23.5 seconds. Like all Greenlee machines it's built for long, continuous service. Can be modified economically if desired. Have our representative give you complete information.

MACHINES DESIGNED
WITH THE FUTURE IN MIND

GREENLEE BROS. & CO.

Since 1863 — 1978 Mason Avenue, ROCKFORD, ILL.

TRANSFER MACHINES • SPECIAL MACHINES • AUTOMATIC BAR MACHINES • WOODWORKING MACHINES AND TOOLS
DIE CASTING MACHINES • TRIM PRESSES • HYDRAULIC AND HAND TOOLS • COMMERCIAL CASTINGS

AIRCRAFT and MISSILES...

The changing aerospace industry . . .

During the past five years the aerospace industry has undergone a profound change. From a production industry it has changed to a research, development and testing industry.

In fiscal 1962 over $2.6 billion will be spent on space oriented programs. This figure includes the additions to the original budget and represents the combined military and NASA appropriations.

The impact of this cascading technology has caused a physical change in the industry, according to *Aerospace Facts and Figures '61*, official publication of the Aerospace Industries Association of America.

Paradoxically, says AIA, the industry has a large amount of excess floor space at a time when it is building new facilities. The reason: In most cases it is less expensive to build a new facility than to convert conventional high-bay plant area to research and development laboratories.

At the same time, the aerospace industry today needs and uses only half the space it occupied five years ago, and the space needed now will be cut in half again in the next three years.

This is the visible effect of the change. Personnel requirements, both in number and type, are following a similar pattern. Technical personnel during World War II made up about 20% of the total work force; today, technical personnel accounts for about 65%.

Aircraft expenditures still high . . .

Past expenditures and those programmed for this year indicate the increasing military dependence upon missiles for both strategic and tactical applications.

Military procurement of aircraft, however, still accounts for some 14.5% of total defense expenditures. While there is no question that missiles will eventually take over a major role in the nation's offensive and defensive forces, says AIA, manned combat aircraft with their proven capability will remain the backbone of US aerospace power for many years hence.

More backing for bombers . . .

Senators Stennis (D-Miss) and Symington (D-Mo) have both urged retention of the $525 million allotted in the defense bill for continued purchase of long-range bombers.

Stennis, chairman of the Senate Preparedness Subcommittee, said testimony that it (the subcommittee) had been taking at closed hearings from top military leaders inescapably leads to the conclusion that the manned bomber is going to be our chief deterrent weapon for years to come.

Symington, a former Secretary of the Air Force, also urged that production be continued. He said that bombers, unlike missiles, could be used in conventional as well as nuclear warfare.

AF studies space radiation . . .

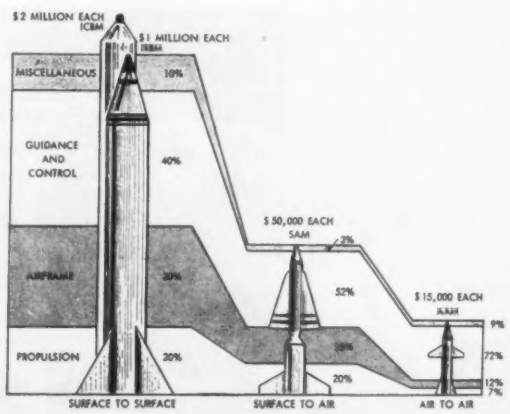
Studies and experiments on the effects of ultraviolet radiation on space vehicles will be continued at National Research Corp (Cambridge, Mass) under sponsorship of the Air Force's Arnold Center.

NRC's new Space Vacuum Laboratory will incorporate an ultraviolet source of increased intensity in one of its twelve environmental test chambers to test typical plastics, metals, and other materials which may be used in space vehicles.

In this advanced program, NRC's research division is combining space radiation and ultra-high vacuum to simulate conditions that exist 600 miles above the earth.

Typical missile production costs . . .

The chart presented below indicates the expenditure is electronics (guidance and control) for various missiles in relation to other expenditures. The chart was prepared by the Economics Division of Stanford Research Institute, Menlo Park, Calif.



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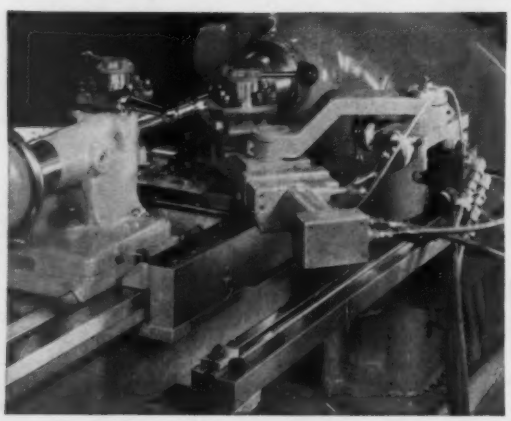
1 **LOWER COST**—Rivett 1020M Manufacturing Lathe is basically the famous Rivett 1020S Precision Toolroom Lathe with the addition of infinitely variable power feeds and power tracer equipment. You get tolerances in tenths plus stepped-up production on quantity work. You'll enjoy steadier output with minimum rejects and elimination of human error.

2 **INCREASED FLEXIBILITY**—One 1020 Lathe gives you a basic versatile machine capable of taking a ¼″ cut in cold rolled steel or turning within tenths. Ideal for any close tolerance work on short or long runs, especially intricate and complicated parts, requiring extremely fine finishes.

3 **MORE VERSATILITY**—The Rivett 1020M handles any turning, boring, or facing within its capacity of 12½″ swing and 20″ or 30″ centers. 1⅛″ capacity collets mount directly in spindle. Tracer unit does not interfere with conventional operation using standard compound. Swivel mounted, tracer turns work between centers using power longitudinal feed, or work held in face plate using power cross feed.

4 **GREATER CAPACITY**—Using simple fixtures, you can rough or finish machine larger, heavier work than possible on other standard lathes of this size. Full horsepower is transmitted to the spindle. Infinite speeds 22 to 3600 r.p.m.



TRACER Equipment consists of a complete cross slide on which is mounted the standard compound at front and tracer unit at rear.

Write For Bulletin No. 1020C1—and ask for quote on this productive machine. You'll like the attractive price!

RIVETT

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MACHINE TOOLS...

No defense business yet . . .

There is no fresh evidence that the increasing defense and space programs will result in any important new machine tool business.

A large Army contract for close-support aircraft is pending. It is reported to call for relatively high-volume production. Whatever airframe builder gets the order may well need new machine tools.

Eight subcontractors are said to have been asked to submit bids by September 1 for manufacture of the M-14 rifle. The M-48 fuse body also is up for bid. These two jobs may require some special tooling. Westinghouse has a tooling program for its steam turbine division in South Philadelphia, Pa, which still is undecided.

Inquiries for tooling of 1963 automobiles are almost totally absent. Builders believe that auto makers are likely to be later than usual in deciding exactly what they want to do.

Export sales continue very good. One builder of general-purpose machines says that overseas orders are up, mostly to South America, Japan and India.

N/C inquiries from Europe . . .

A midwest builder has been receiving inquiries for numerically-controlled machines from England, France and Spain. He shows little interest because of the cost of servicing which the customer would have to pay.

Sales to West German and Italian buyers have been picking up, another builder states. Orders from Japan have been holding up well.

July was the best month in more than a year for a prominent Ohio builder of standard machines. This company is increasing modestly its production schedule for early next year in anticipation of improved domestic business.

The fact that big defense orders might suddenly be placed sometime in the next six months leads several builders to the opinion that this factor is likely to drive in quite a bit of non-defense tooling business in the next few months.

One producer of N/C systems for machine tools is pleased with the upward spiral of applications, which "seem to have no end." Another producer has taken six orders for systems in the past 30 days. He reports a resurgence of activity among large subcontractors to aerospace firms.

Ingersoll-Waldrich agreement . . .

Ingersoll Milling Machine Co, Rockford, Ill, and H A Waldrich GmbH, Siegen, Westfalen, Germany, have agreed to exchange advanced designs and technical know-how, with each building machine tools and production systems of the types in which the other has specialized.

Ingersoll will produce Waldrich heavy-duty lathes and roll grinders at Rockford. Waldrich will make Ingersoll special machines for the European market.

Waldrich Siegen-Ingersoll Werkzeug GmbH is being created by the two companies to supply milling and boring cutters and cutter blades from a tool manufacturing plant to be erected in the Siegerland area of Germany. The new company also will supply prompt technical services to European customers. It will have the benefit of the technical experience and know-how of Ingersoll's Cutter Division.

Waldrich-Ingersoll nameplate will be seen for the first time at the European Machine Tool Exhibition at Brussels next month where an adjustable rail milling machine built at Rockford, a small one as Ingersoll machines go, will be shown along with Waldrich machines and a new Ingersoll automatic cutter grinder.

Expect gain in '62...

Metalworking machinery companies forecast their new-orders bookings for the third quarter of this year at 191 on an index which takes 1950 as 100. For the fourth quarter they predict the orders volume at 196, with a jump in the first quarter of 1962 to 230 and in the second quarter to 248. These figures compare with 223 for the second quarter of this year.

The McGraw-Hill Economics Department forecast of new orders for machinery, in six categories (of which metalworking machinery is only one), is detailed on page 105.

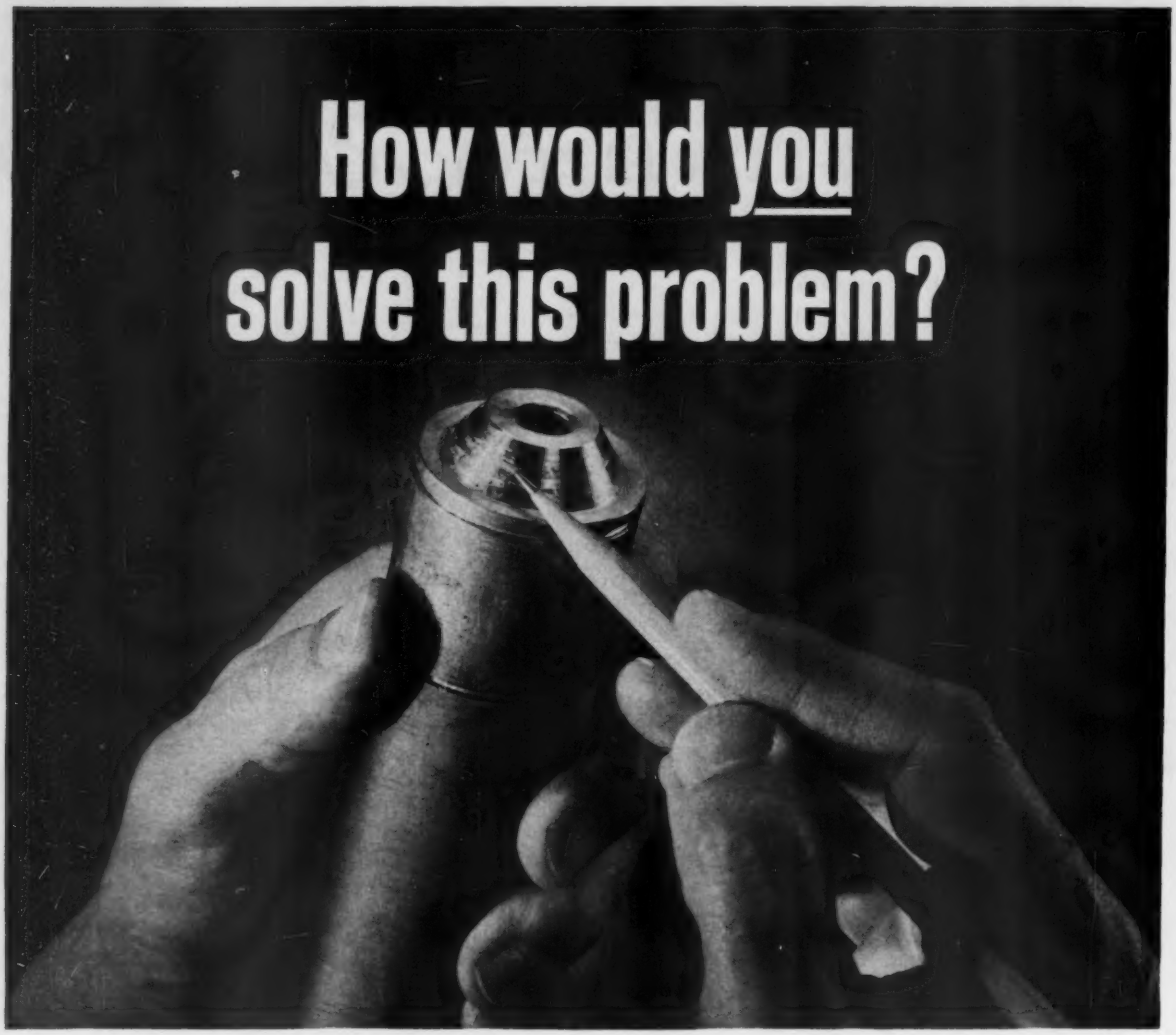
To increase Japanese imports . . .

Mitsui & Co Ltd is stepping up its activities in this country by appointing the Shanler Marketing Co to handle sales and servicing of all Mitsui-imported precision machine tools. The new firm will be located at Mitsui's New York branch at 530 Fifth Avenue.

The step-up is based on current import demands and the relatively long European deliveries. It includes "rapid introduction of Swiss-type automatic lathes, grinders, toolmakers', turret and production lathes, and many more."

BF

How would you solve this problem?



This roller-end component was produced from cold finished bar stock. During machining of the close-tolerance load-bearing surface, these problems were encountered: frequent tearing sent reject rate sky-high, slowed down production—and tool life was abnormally short.

A Ryerson Metalogics specialist analyzed the problem and suggested Ledloy® 375, world's fastest machining steel. This proved an excellent choice—rejects virtually vanished. Ledloy 375 boosted tool life . . . cut machine down-time . . . permitted increased feeds . . . and gave a better finish.

And here's why Ledloy steels from Ryerson assure you of top machinability with consistency. No two mills get the same results in steelmaking. So Ryerson buys all Ledloy "hot stock" from just *one* mill. Their exacting quality standards, and our own rigid controls, assure you top machinability—consistently.

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MATERIALS...

Tungsten-alloy strip . . .

Experimental production of tungsten-alloy strip from centrifugally-cast material is underway at Oregon Metallurgical Corp. Cast material is directly rollable to sheet or strip and no prior breakdown of the tungsten alloy by forging or extrusion is required. Also, the material can be rolled at much lower temperatures than was expected. A 98% tungsten—2% molybdenum alloy was rolled at 1832F from an as-cast thickness of 0.64 inch to a finish thickness of 0.035 inch without any intermediate anneal or recrystallization.

Fine grain size in the cast material is credited with permitting direct rolling. Directional heat flow in arc casting tends to produce columnar grains. Rapid solidification of centrifugal castings against a graphite mold results in equiaxed grains approximately one-fifth the size of arc-cast grains. Strip is made by sawing a casting in two or more segments and rolling the segments. A 130-pound tungsten casting will produce two sheets approximately 36 in. x 120 in. x 0.020 in. thick; probably larger than the capacity of available rolling mills or furnaces.

Oremet, in Albany, Oregon, can supply centrifugal castings in virtually all refractory metals and alloys.

Milestone in energy application . . .

Capacitor-discharge techniques hold all sorts of fantastic possibilities, including many materials-working innovations, we are told by Dr Richard H Wesley of Electro-Hydraulics, Inc, Dallas and Ft Worth, Texas. One result to be expected is a variety of new materials. Capacitor-discharge has made possible such developments as electrical discharge machining, the spark bomb, and electromagnetic forming, as well as electron-beam furnaces. And these are only the beginning.

Providing a tremendous energy release in millionths of a second, this technique has, among other characteristics, a shock wave effect that creates an entirely different reaction in materials than conventional rates of energy release; a reaction that has never before been achieved on a controllable basis.

The pressure wave can shape, emboss, blank, or plate most materials with no molecular deterioration from stress or heat. It can weld or bond and swage.

It can harden some metals and deep draw or extrude hardened metals without cracking them. Capacitor-discharge is expected to play an important role in chemistry, biology, and geophysics as well as in metallurgy and metalworking.

Wide-sheet galvanizing . . .

The widest continuous-sheet galvanizing line ever built has been unveiled by Armco Steel Corporation at Middletown, Ohio. Having an average capacity of 30 tons of zinc-coated steel, in sheet or coil form, per hour, the new facility is 565 feet long and nine stories high.

In 1960, galvanized steel reached a record of 3,056,996 net tons shipped in spite of the generally lower operating rates in the steel industry. Industry estimates for 1961 shipments reach as high as 3,300,000 tons. Armco president Logan T Johnston is confident that proved applications and new uses, made possible by improvements in fabricating properties, weldability, and paintability, will further accelerate growth.

Major users of galvanized steel sheets and coils are: architectural and building components, automotive, heating and air conditioning, agricultural products, and appliances. Automotive use increased from 8.9 pounds per car in 1954 to nearly 100 pounds per car in 1961. One reason is the overall corrosion resistance of all body members necessary in the unitized body. Building contractors' items such as metal windows, roof drainage systems, and various cold-formed building products set a record of 436,844 tons.

Giant metal-powder parts . . .

Shaping powdered metals into forms up to five feet long and twelve inches in diameter, a new hydrostatic press at the Carmet Division of Allegheny Ludlum Steel Corp will produce long boring bars of tungsten, steel (and for refractory metals) mill rolls, billets for vacuum-arc melting, and nuclear fuel elements. Mass production of smaller shapes usually formed in hydraulic and pill presses also is possible.

Designed on the principle of Pascal's Law, which holds that the pressure exerted on a mass of fluid is transmitted undiminished in all directions, the new press exerts, through a water medium, 50,000 pounds of pressure per square inch. The interior of the chamber is six feet long and 16 inches in diameter. It contains 60 gallons of chemically treated—to prevent freezing at room temperature—water. Vertical design permits heavy molds to be lowered into and removed from the cylinder with an overhead crane.

For compacting, powdered metal is tightly packed into rubber molds, then cased in perforated steel tubes and placed in chamber.

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WHAT'S AHEAD... in Metalworking

TRENDS

At 1961 peak, metalworking awaits new gains . . .

Metalworking production, still at its 1961 peak of 107 on the AM/MM Index, is expected to make even further gains when summer shutdowns taper off and industry makes its usual fall comeback.

Steel production should rise in September if incoming orders continue at the present rate. There have been no reports of increased steel orders from Detroit. In fact, there have been reports of hold-backs caused by uncertainty over the outcome of auto labor negotiations.

Auto parts manufacturers are optimistic about the rate of orders for 1962 model cars. One major producer reports orders are at about the same rate as last year, but another says that the second quarter of 1961 topped that of 1960. This is somewhat counter to the industry trend.

Contract tool and die makers see signs of a healthy gain in the administration's emphasis on conventional weapons, and they have been hearing rumors of substantial, and early, ordering from Detroit.

Cutting tool manufacturers look forward to substantial business increases in September. Several major companies report that July, usually a slow month, was a good month for sales. Orders from machine tool builders, particularly those in the numerical control field, are quite good.

New orders for gears rose about 11% in the latest month according to the AGMA. The association's booking index rose to 220 (1947-49=100).

Industrial fastener shipments rose for the second straight month, reaching a level of 90 (1956-58=100) on the shipments index of the Industrial Fasteners Institute. This was a gain of four points over the previous month.

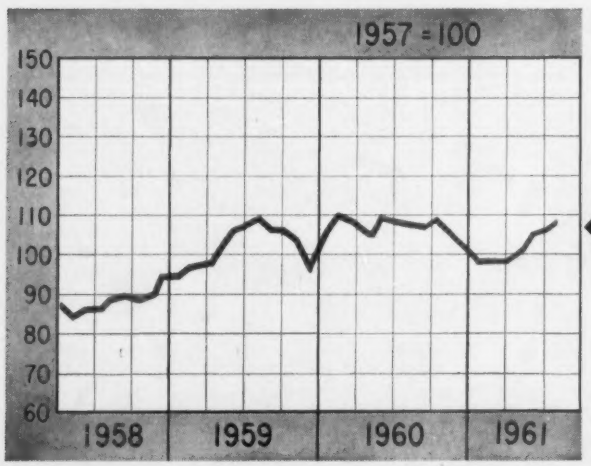
Metalworking job shops appear to be heading for a good year. "Better than '60," said one, "and that was a good one." Some report business up as much as 15% all along the line. A defense buildup will boost business even more.

Metal stampers say that business is good but that profits could be better. Increased defense work is expected here, too. The outlook for the rest of the year is good, with some stampers predicting gains over the last two years.

Industrial heat-treating equipment builders say that orders are definitely up. The industry had a poor last quarter in 1960 and a slow first half this year. As one manufacturer put it, "The recovery came just in time for us and we're optimistic about the rest of 1961." The Industrial Heating Equipment Association reports that net new orders for the latest month are more than double those of the same period last year.

Appliance sales picked up with the hot weather of recent weeks, and some appliance men feel that the turnaround has come and that buying in the second half will be at a substantially higher level than in the first half.

Materials-handling equipment manufacturers report that the summer slump hit just when they were experiencing a pickup in ordering. They do not foresee a big change for some time.

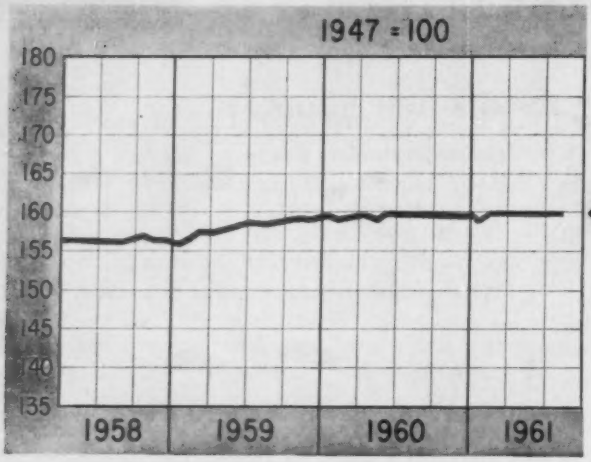


AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	JUL Estimated	JUN Preliminary	MAY Revised	JUN Year Ago
Total Index	**107**	**105**	**103**	**107**
Machinery		**101**	**99**	**104**
Electrical Machinery		**114**	**112**	**114**
Autos		**114**	**107**	**120**
Other Transportation		**89**	**90**	**83**
Other Metalworking		**110**	**108**	**112**

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	JUL Estimated	JUN Preliminary	MAY Revised	JUN Year Ago
Total Index	**159.6**	**159.6**	**159.5**	**159.4**
Metalworking Machinery	**193.8**	**194.1**	**192.2**	
Other Machinery exc. Electrical	**174.0**	**174.0**	**172.5**	
Electrical Machinery	**158.5**	**158.5**	**160.2**	
Fabricated Metal Products	**147.2**	**147.0**	**147.7**	

Defense and the economy . . .

Despite the usual summer slackness in many industries, events are occurring that will have an important impact on industrial production and the economy generally. Most important of these is, of course, the revision our defense posture is now undergoing.

Undoubtedly, US defense expenditures will rise substantially in the months ahead. By year's end, federal defense outlays will be running at an annual rate exceeding $51 billion. By mid-1962, the end of the fiscal year, defense spending will be in the $53.5 billion range—$5 billion higher than in this year's second quarter.

Clearly, this enlarged defense budget will have a major impact on the level of the nation's economic activity and its employment. But mostly, concern is over its impact on the price level.

For even without beefing up defenses, the federal government was likely to operate in the red this year, ending the fiscal period with a $5-billion budgetary deficit. In view of the military preparedness program, most experts now foresee a $6.5-billion federal deficit for the current fiscal year.

To many, federal deficits clearly signal rising prices. Actually, however, 1959, the year of the biggest peacetime deficit, saw prices remain stable though the government operated $13.5 billion in the red.

A major buffer against inflation in the immediate future is the remaining margin of unused industrial capacity available in the U S. Although output has grown considerably in recent months, many industries still are producing less than their preferred output volume. Only as this gap between output and capacity closes will many industries begin to feel the pressure to raise prices.

Thus, despite a substantial federal deficit in prospect, businessmen can plan on relatively stable price levels in general economy in the months ahead.

WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49 = 100)*	153.9	153.8	147.4
Steel ingot production (thousand tons)	1,850	1,818	1,537
Electric power output (million Kilowatt hours)	16,137	16,107	15,125
Production of automobiles	32,020	74,831	103,504
Engineering construction awards (*Eng. News-Record*, thousands)	$80,188	$81,744	$78,441

MONTHLY BUSINESS INDICATORS	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	294	274	268
Vacuum cleaners sales (thousands of units)	241	265	267
Washers sales (thousands of units)	187	164	177
Household electric ranges sales (thousands of units)	69	80	63
Radio production (thousands of units)	784	739	1,277
Television production (thousands of units)	463	409	442
Gear sales index (1947-49 = 100)	193.7	246.2	246.9
Foundry equipment new orders index (shipments, 1947-49 = 100)	101.5	115.2	159.0

* Seasonally adjusted

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HOW IT OPERATES: Readings from a precision scale, affixed to a machine tool, are transmitted through a 22-power lens system onto an illuminated, highly visible, direct-reading dial. Readings are in .025" intervals. A double spiral reticle on the dial provides the final measurement refinement to .0001" without interpolation. All readings are complete within the dial area eliminating reference to an outside pointer.

*The scale is a replica of a master certified by the U.S. National Bureau of Standards to .0001" maximum error over its entire length.

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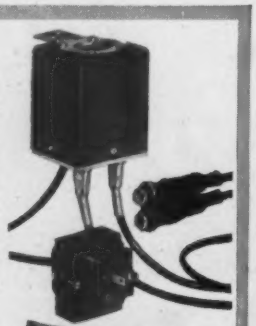

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Time to Dispel the Fog

With much fanfare President Kennedy recently announced to the nation and to the world an expansion in our defense program. New and commendable emphasis is to be put on weapons for limited warfare, he said.

Since then, the President has asked Congress for about $1.8 billion to carry out his program. Beyond that, there is no visible evidence of any attempt to inform industry, or anyone else, of what is going on or what is going to be done.

It is a natural assumption that if we are to be prepared for any kind of war, limited or otherwise, we will base our plans on the newest weapons developed by modern technology. Such weapons would consist of the most up-to-date rockets and missiles and guns and tanks that our ingenuity can devise.

The prototypes . . .

of these weapons are said to be in existence. If they are to be put into production, plants will have to be tooled for them.

Yet, strangely, no agency in Washington associated with defense operations knows of any plans at all for any sizable tooling expenditures. In fact, the armed services and their contractors are engaged in important liquidation of the nation's military production equipment at the same time that the White House is trying to create the impression that a full-fledged national emergency is just around the corner.

"From one of America's finest electronic plants used in the manufacture of missiles, aircraft and radar parts," an advertisement says that $1.5 million of precision machinery and equipment is to be sold. Most of the listed items are "new since 1953."

If precedent holds, these tools will be sold for about ten cents on the dollar. The Army has been disposing of machinery at auction at ridiculously low figures recently. And more auction sales are coming up. Our national production resources thus are being broken up and scattered so that the loss cannot be retrieved.

All of this is occurring . . .

at a time when Washington gives no indication whatever that it knows what industry's capability is for making the newest weapons. Remember that the precision with which these weapons have to be made is a far cry from the standards of World War II.

We waited until World War II was upon us before we decided to tool defense facilities. It then took us two years to build the machines for the tooling program. We were caught exactly the same way in the Korean war. Is history going to repeat itself?

At this juncture it is difficult if not impossible to find out in Washington what the defense production score is. Metalworking manufacturers do not know whether the government is talking big to impress the world or whether it means business. They do not know whether they are to be asked to get into a much-enlarged defense program.

They have no inkling of it . . .

if the government has any serious intent to tool up for production of modern technology's latest weapons as part of its defense build-up. The current dissipation of the nation's machine resources by ten-cent liquidation is evidence that there is no such serious intent.

The administration will do the country a service by clearing away the fog of uncertainty that now envelopes the defense program. It should take industry into its confidence without delay and spell out its specific plans.

Burnham Finney EDITOR

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14 reasons to consider tape-controlled Gilberts

Summarized here are the main reasons you should consider Cincinnati Gilbert's numerically-controlled 4" and 5" horizontal boring mills. We suggest a letter or phone call for complete information—or, better yet, a visit to the plant to see an actual demonstration. The Cincinnati Gilbert Machine Tool Co., 3366 Beekman Street, phone KIrby 1-4815, Cincinnati 23, Ohio.

GILBERT

VOL 105, NO 17 **American Machinist** / *Metalworking Manufacturing* AUGUST 21, 1961

Why first-stage engine cases test out 100% AOK

Building the Minuteman's shell

By Ben C Brosheer,
associate editor

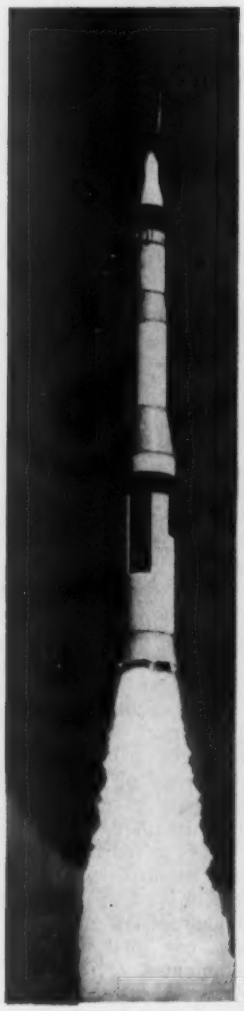
To date, not a single one of the first-stage rocket engine cases for the Minuteman ICBM has failed in silo or firing tests—an almost unheard of achievement for any ballistic missile component.

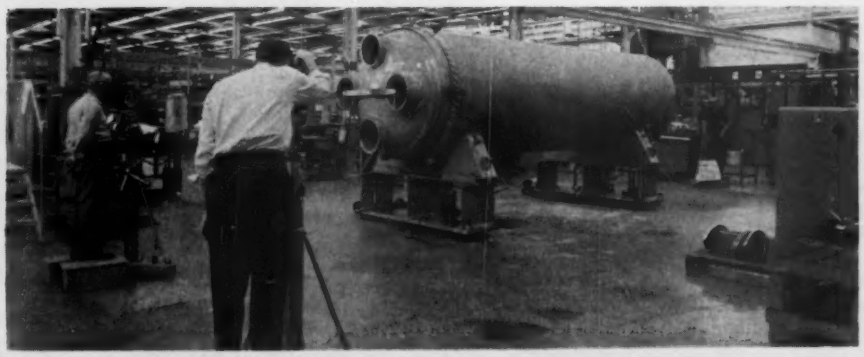
This 100% reliability record was not achieved by accident. On the contrary, it is the end result of careful pre-planning by General Motors' Allison Division.

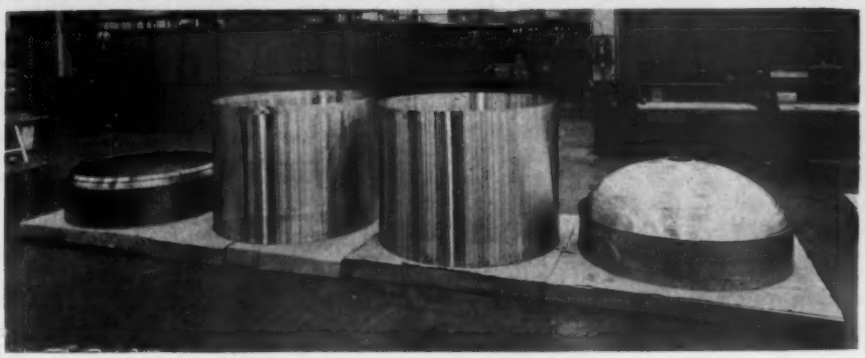
Allison's insurance policy against failure: hydrostatic testing of subscale models and full-scale prototypes before releasing the final case design to the shop. The cases are produced under subcontract to Thiokol Chemical Corp, prime contractor for the first stage of the Minuteman.

The cases, which are approximately 22 feet long and 65½-in. OD and made of high-strength steel, have no internal bracing yet must withstand the terrific strain of solid-propellant firing without distorting or bursting.

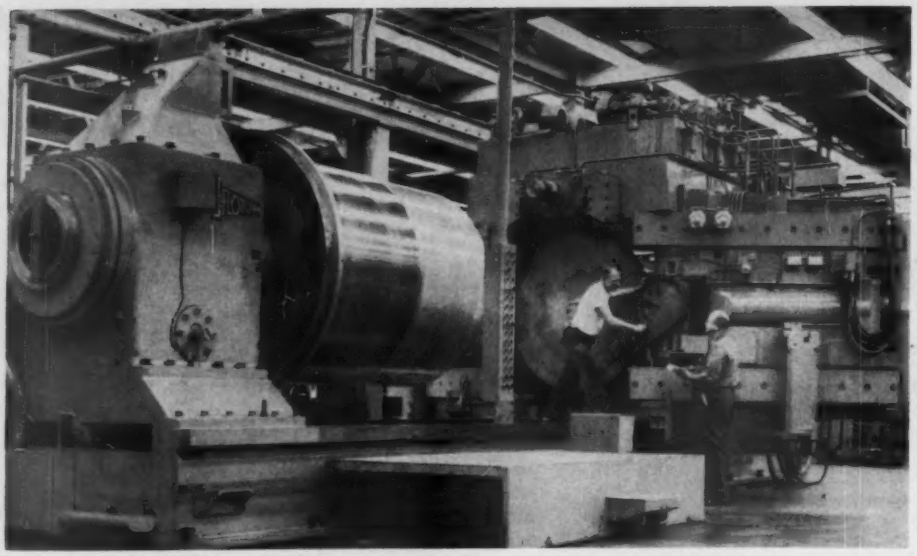
They are, in effect, thin-walled pressure vessels—except that few, if any, such vessels are made with such care, and to such close tolerances. By







America's first solid-propellant ICBM, designed to carry a nuclear warhead over 6000 miles at a speed of 15,000 mph, has its first stage engine encased in a 22-ft-long, 65½-in. OD cylinder (upper right) made from machined forgings. Case components (lower right) consist of four roll-formed and machined cylinders (two not shown), a forward dome (right), and an aft adapter (left) welded together. The Minuteman is slated for operational duty sometime next year



Dual-roller Floturn shear-spinning lathe (a Lodge & Shipley No. 70 horizontal) has capacity to form cylinders up to 70-in. OD and up to 84-in. long, was developed to roll-form cylindrical case sections from forged steel rings, and other rocket engine case components from flat or preformed blanks

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making the case components from carefully selected steel, and by controlling forging, machining, welding and heat treating closely, Allison has achieved ultimate tensile strengths of 240,000 to 250,000 psi in the case walls.

Each case (before being shipped to Thiokol to be filled with propellant) is hydrotested to a proof pressure that is about 90% of design yield pressure. These hydrotests simulate actual firing conditions, and provide strain data for qualifying each case.

Subscale prototype tests

Before fabricating the actual first-stage cases for the Minuteman, Allison evaluated case designs and materials by making, and then hydrotesting to failure a large number of 24-in.-diameter pressure vessels. These ranged from simple cylinders to scale models of complete cases—including aft closures, blast nozzle tubes, thrust skirts, and various types of joints between the aft adapter and the separate aft enclosure.

The subscale cases were hydrostatically burst-tested at internal pressures (representing ultimate tangential stresses) as high as 290,000 psi. Strain gage data, obtained during hydrotesting, was correlated with analytical data.

Out of these tests, for one thing, came a tapered-thread closure joint which was later applied to the actual Minuteman engine cases, and to other missile engines employing solid propellants.

This joint, which attaches the aft closure dome to the case assembly, consists of a tapered buttress thread modified to insure maximum load-carrying capacity.

While this design weighs much less than similar types of mechanical joints, it withstands high stresses, and has the additional advantage of transmitting loads continuously around its periphery (as opposed to the point loading normally associated with bolted joints).

Results of subscale testing

Out of Allison's subscale testing program came data that enabled the company to select the best materials for case components, optimum weld joint geometery; the right welding, heat-treating and machining procedures.

It was possible, too, to evaluate such welding variables as filler material, current, voltage, traversing speeds, and pre- and post-weld thermal treatments for subscale cases and for large rings.

Not only that, Allison's subscale case fabrication program helped determine early what design features would be needed in the huge welding fixtures that would later be used in making the cases.

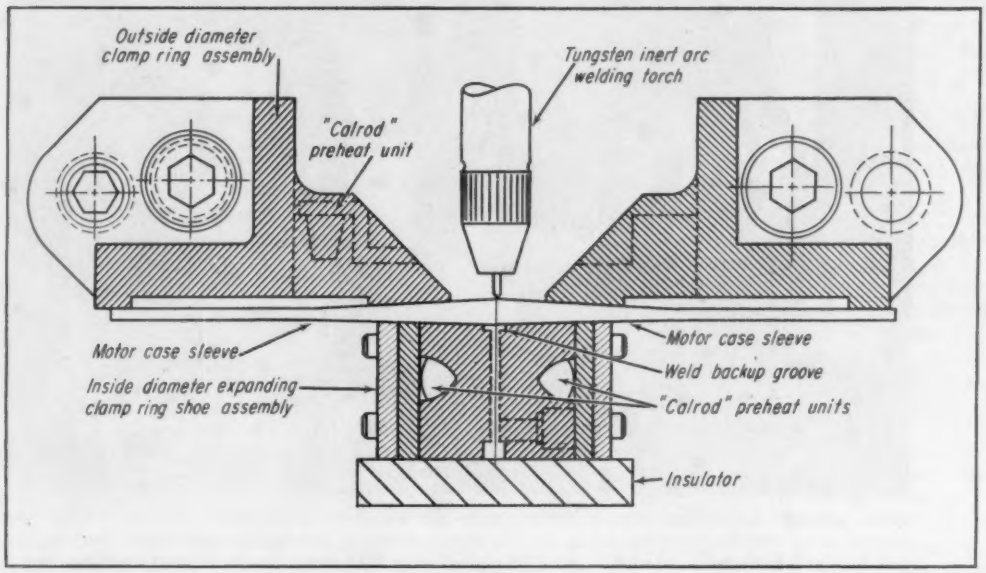
Also worked out on the subscale prototypes were heat treating procedures which were later used in the full-size cases.

Even now, Allison is continuing with subscale testing on the Minuteman—although its first-stage case design has been fully qualified for production—to investigate ways to cut costs. This is being done by making and hydrostatically testing cases with components finished by roll forming (shear spinning), hot cup-cold draw forming, mandrel forming (for domes), and similar metalworking procedures.

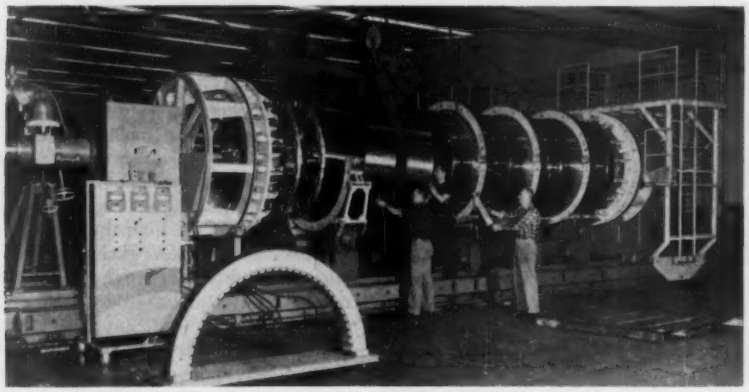
The payoff

"Subscaling" has already paid dividends. For instance, a Floturn shear-spinning machine, recently installed for making cylindrical case components from rough-turned ring forgings, is estimated to have saved at least 50% in weight of purchased raw material, and to have cut cylinder machining time 80%. And because only three cylindrical case components are needed with Floturning (instead of the four required when the components are machined from forgings), one girth welding operation is eliminated.

Similar tests with subscale cases have effected substantial reductions in heat treating costs, including savings in handling time and in time at temperature in the furnace.



Outside clamp rings and internal backup ring (assembled about the weld joint) contain Calrod resistance heating elements to heat the joint before and during welding passes. Backup ring has 12 segments which are moved radially with hydraulic cylinders, and which are grooved to hold a blanket of inert argon gas under the joint



Rocket engine cases are progressively aligned, clamped and welded in specially developed Lewis welding fixtures. Each cylindrical case section is held in a split sizing ring which is supported by rollers in a steadyrest adjustably positioned on the fixture base. End components are held in headstock and tailstock

They have also helped find procedures for inspecting girth butt welds in case assemblies. Today, an x-ray inspection is made of each weld soon after it is completed. Then all welds are checked with radiographic, magnetic particle, and fluorescent penetrant procedures before and after the component is subjected to heat treat.

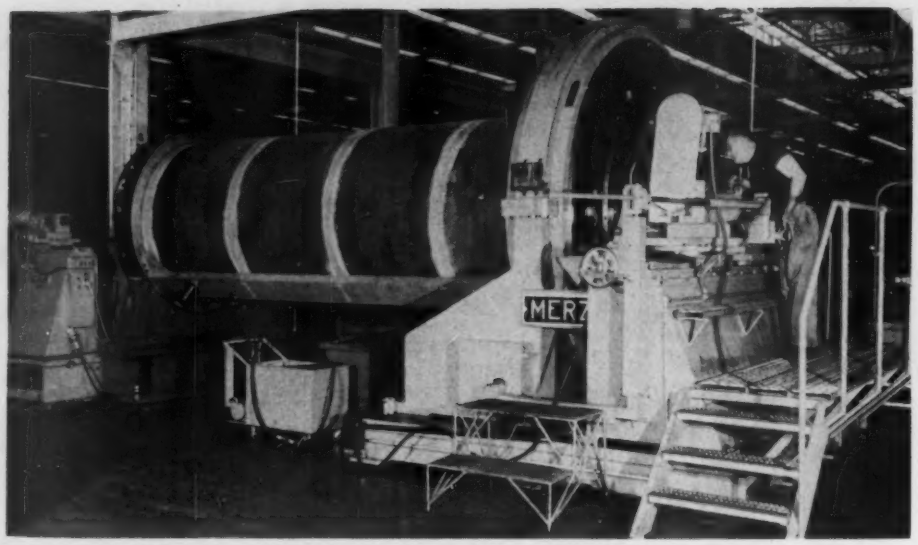
Dimensional control and accurate alignment of case components (essential in meeting 0.120-in. TIR alignment tolerance of the case after heat treatment) have also been aided by subscale tests.

Early experience with the 24-inch OD scale models led to adoption of optical and electronic setups for checking complete cases, for checking wall thickness of components, and for aligning the cases with their central axes when setting them up for machining.

Forged case components

Case components are machined from forged high-strength steel cups and rings, then assembled into a cylindrical thin-walled vessel—with only girth (circumferential) butt welds. To date, there are no longi-

Roll-formed, stress-relieved and rough-trimmed cylindrical missile case components are stressed to size with a Grotnes expander set in a floor pit for ease of handling work. This unit has capacity to size 44 to 75-in. diameter cylinders up to 80 inches long



When adapter ring surfaces of the rocket engine case have been milled and hobbed (to produce precision tapered-buttress threaded joint), the aft closure dome is assembled to the case. Because the case has been hardened to RC 45-50, nitrided high-chrome HSS cutters must be used for these cuts

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tudinal seam welds in any of the Allison-made cases.

The advantages of this method:

- The case is stronger, because girth weld stresses are much less severe in cylindrical pressure vessels than are longitudinal weld stresses.
- Maximum physical properties are attained by forging the components from carefully selected steel billets. These properties are retained (and usually improved) by welding, heat treating and machining procedures worked out with the subscale prototypes.
- Machined forging takes advantage of facilities already available in subcontractors' plants. Thus the only additional cost is for special tooling and inspection equipment for specific components.
- Design flexibility is achieved by machining case components from forgings, because the design can be easily altered to provide reinforcement in the exact configuration required. Typical areas: girth weld joints, aft closure blast tube pads, and aft closure threaded joint. And forging and machining of the igniter unit pad and thrust skirts integrally with major components eliminates welding in those areas.

The materials

Allison, recognizing that maximum strength, minimum weight and consistent reliability called for carefully selected steel for the forward dome, aft closure dome, aft adapter ring and cylindrical case forgings, chose from four groups of high-strength steels. These include some low-alloy hardenable steels, several hot-work die steels, martensitic stainless, and precipitation-hardenable stainless.

The low-alloy hardenable steels (including several modifications of AISI 4340 which have been used for some time by the aircraft industry) generally have been preferred.

Allison's choice for the first-stage case of the Minuteman is an ultra-high-strength, low-alloy modification of AISI 4340 produced by the vacuum consumable-electrode furnace process, and containing approximately 0.50% nickel, 1.00% chromium and 1.00% molybdenum.

This steel has very favorable mechanical properties, excellent fabrication characteristics, can be welded easily with automatic inert gas-shielded arc processes to produce sound joints, and has a satisfactory response to thermal treatments. A minimum of fixturing is required during heat-treatment to prevent and correct distortion. And this steel is available from a number of suppliers.

From the start, forward domes, aft adapter rings, aft closure domes and cylindrical case wall sections were forged and machined to exacting specifications by several subcontractors. Heat-treating operations on the assembled cases were also assigned to a contract heat-treating firm that installed special furnace equipment.

In each case, Allison has worked closely with these subcontractors to insure parts of highest-possible quality and dimensional accuracy.

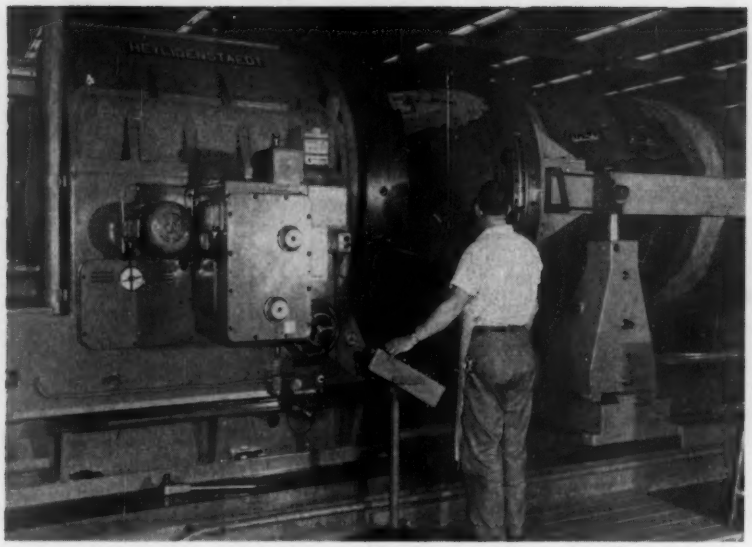
Steel mills were furnished with a detailed specification, to assure delivery of "clean" forging ingots to the forge shop. From samples cut from each of these ingots it is possible for Allison metallurgists to forecast the yield strength of each component when properly processed.

Forging and machining of the end components for the missile cases generally follow conventional practices. In each case, master tracing models for contour milling machines and master templets and gages are furnished by Allison, or are checked and qualified in the Allison inspection department.

Forging and machining

Forging and machining the thin-wall case cylinders presented some unusual problems. Available equipment limited the length to which the cylinders could be made, making it necessary to divide the straight section of the missile case into four sections.

Seamless ring forgings for the individual straight sections were rough and finish turned, bored and faced



Outboard arms, bolted to 75-in. OD faceplates of Heyligenstaedt lathe, hold carbide-tipped tools for skirt machining operations. Each headstock is controlled separately from a pushbutton panel on pedestal

to 65½-in. OD, 48½-in. length, and a little less than 5/32-in. wall thickness—in vertical boring mills.

With such a thin wall (compared with the diameter and length of cylinders) turning and boring to close tolerances for wall thickness and straightness was not an easy assignment.

Size of the components made checking wall thickness of straight case sections and of end components difficult. This has been solved by using direct-reading Magnaflux SO-100 "Sonizon" ultrasonic thickness gages. When calibration of these instruments is checked against a sample of the same material with a known thickness, they are said to measure thicknesses of 0.014 to 0.500 in. with an accuracy of ±1%—more than adequate for missile case components.

All missile case components shipped to the Allison plant by a subcontractor are delivered first to a receiving inspection area for a 100% check of critical dimensions and contours, as well as for a metallurgical check of accompanying test samples. Approved parts then go to a "process stores" area until needed for assembly of a missile case in a welding fixture.

Shear spinning

To minimize material requirements and machining time, Allison shear spins, trims, and sizes three straight case-wall cylinders for each engine from forged steel ring blanks. The blanks weigh only one third as much as one of the four ring forgings needed for machined-case cylinders.

These straight cylinders are cold rolled to the same wall thickness as the machined cylinders.

Laboratory and subscale model tests have demonstrated that yield and burst strengths of the roll-formed, stress-relieved, trimmed and sized case cylinders are well above qualification requirements.

Missile cases incorporating these cylinders, hydrotested to destruction, have proved to be as strong or stronger than those made with forged and machined wall sections.

Experiments at L & S

Original experimental work on roll-formed case sections was carried out in the Floturn Development Shop at the Lodge & Shipley plant in Cincinnati, where case sections for subscale models were produced.

Later, full-scale sections for the first-stage Minuteman rocket engine were roll-formed from rough-machined ring forgings on a 70-in. single-roller Floturn lathe in a subcontractor's plant.

Results were so good, and the potential savings so high, that Allison has purchased and installed a specially-designed No. 70 horizontal Floturn lathe equipped with a dual-roller carriage (*AM/MM*—Jan 9 '61, p105). Each of the two roller slides on this machine can exert a force of as much as 70,000 lb on the rotating workpiece.

Present procedures for roll-forming straight, thin-wall cylinders from forged steel rings, while holding wall thickness within ±0.002 in., are as follows:

1. Inspect ring forging upon receipt, using dimensional gages, and magnetic particle and radiographic procedures.
2. Clean all surfaces of ring.
3. Roll-form cylinder from rough-turned forging in dual-roll Floturn machine. Several passes are required to develop the desired cylinder dimensions.
4. Stress relieve roll-formed cylinder in Lindberg vertical furnace.
5. Clean cylinder by sandblasting.
6. Rough trim cylinder to length in Lodge & Shipley missile lathe.
7. Size cylinder in special vertical Grotnes expander.
8. Finish trim cylinder to length in L & S missile lathe.
9. Inspect—check all dimensions and use magnetic particle process to insure no surface flaws.
10. Weigh cylinder, then deliver to process stores.

Large welding fixtures

Special care is taken in aligning adjoining components when they are assembled in large Lewis welding fixtures for welding the joining girth seams. All welds are made under carefully-controlled conditions to insure full penetration without flaws or porosity.

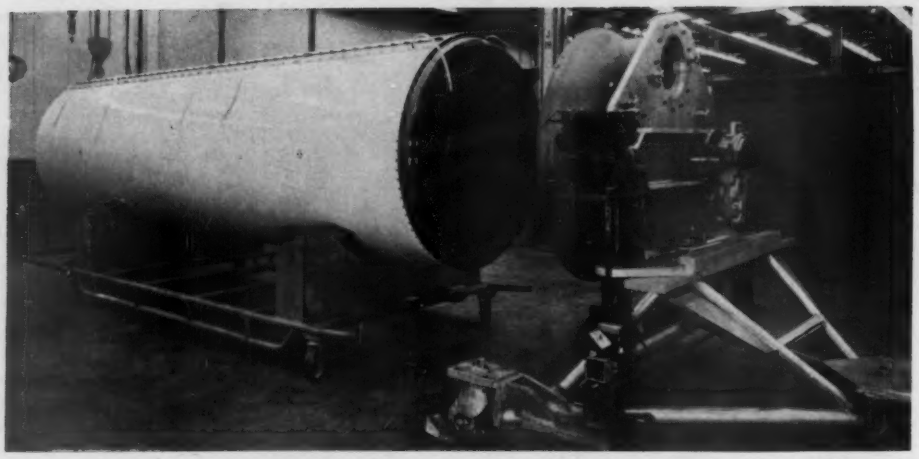
Each of the large welding fixtures has a headstock and a tailstock adjustably positioned on a 30-ft-long bed, and each has a fixture for supporting and aligning the forward dome and aft adapter ring at opposite ends of the rocket engine case.

Assembly of a missile case progresses from the headstock end of the fixture: each successive component is positioned, aligned, welded and x-rayed before the next component is brought to the fixture.

As the case is built up, successive straight case units are supported in a large, split sizing ring whose periphery rides on rollers in a steady-rest support unit adjustably positioned on the fixture base.

A carriage mounted on rails (located between each pair of welding fixtures) carries a radial-arm manipulator on which is mounted an inert gas-shielded automatic head that makes welds alternately at both fixtures.

Two welding passes are made, as the work rotates slowly under the welding head. All variables—current, voltage, flow of internal and external shielding gages, traverse



Aft closures must be mounted and removed from end of rocket engine cases several times during machining and finishing operations. For this reason, power and manually actuated fixture has been developed to turn the aft closure as it is fitted to a taper-threaded aft adapter ring on base end of case

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speed and the feeding of filler metal wire—are controlled automatically. The welding operator stands on a movable carriage positioned close to the weld, so that he can observe welding conditions.

As soon as possible after an internal backup ring and external clamp rings have been removed from a welded joint, the weld is post-heated with a 400-cycle induction coil, consisting of seven turns of ½-in.-diameter flexible copper cable.

Radiographic inspection

When cooled slowly to room temperature after the post-heating operation, the welded joint is rough ground manually inside and out. Then the weld is x-rayed completely and finish ground internally and externally before the next section of the missile case is positioned and welded into place.

During radiographic inspection, the area is shielded with a lead-lined box, open at both ends so it can be lowered over the missile case in the welding fixture. Adjustable lead-faced shields are positioned around the area at each end of the box, so anyone working in the vicinity is fully protected.

When a missile case is completed, it is removed from the welding fixture and inspected thoroughly—visually, with dimensional gages, and with magnetic particle and fluorescent penetrant procedures—before being packed in a container for shipment to a subcontractor for heat treatment. Inspection procedures are repeated, and the welds are again x-rayed, when the heat treated case is returned to the Allison plant for further processing.

Straightness and concentricity checks are made with the heat-case set vertically on one of two 48-in.-diameter precision indexing tables in the receiving inspection department (one on either side of a vertical rail along which optical targets or an electronic gage head can be positioned).

Either of these inspection setups can provide repeatable measurements within 0.001 in. consistently, but the electronic gage method is generally preferred because it requires only about half the time needed for a complete optical inspection.

Hard-to-machine steel

Machining of heat-treated missile cases is difficult because they are hardened to RC 48-50. Only high-chrome HSS milling cutters, hobs, drills and taps, and carbide-tipped lathe tools can be used with satisfactory cutting-edge life.

Three machines do the job: a special Merz lathe equipped with a milling and hobbing tool head, a large double-end Heyligenstaedt lathe for turning skirts at both ends of the missile case, and a drilling and tapping stand which employs Keller Airfeedrills suspended from frames at each end.

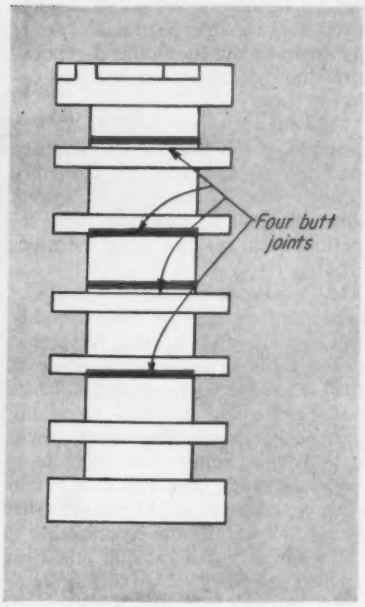
Precision optical instruments align the cases concentric with the axis of each lathe, to make it possible to hold close concentricity tolerances.

Each missile case is clamped in a trunnion cradle with heavy steady-rest support rings at each end, for supporting the assembly in the Merz lathe. Four trunnion support pins are used in the Heyligenstaedt lathe setup.

In the Merz lathe, the aft adapter ring is milled and hobbed while the missile case is turned slowly—roughing and finishing the pilot and seal face surfaces, and generating the tapered buttress thread with which the aft closure later is joined to the case. These surfaces must be finished concentric within 0.003 in. TIR, and thread depth must be held within 0.002 in.

In the Heyligenstaedt lathe (where skirts on both ends of the missile case are turned and faced concentric with the axis of the assembly) the workpiece is held stationary on four pedestals. Carbide-tipped, single-point tools are supported on extension arms bolted to the face-plate of each of the two opposed headstocks.

Final operations on first-stage rocket engine cases for the Minuteman ICBM include a series of sand-blasting, painting, insulating and bracket assembly operations—all interspersed with careful inspection operations, and a fully-instrumented hydrotest. •



Combined furnace brazing and hardening of stainless servo valve inserts produces high-strength (150,000-psi plus) joints, eliminates later heat treating of a complex assembly. Five separate pieces are positioned by mandrel, then brazed (and hardened) to form an insert

Metallurgical defects are minimized as . . .

Heat treating teams with brazing

By John J Lawless, Jr
Vice president
Metallurgical Consultants, Inc
Montebello, Calif

By combining brazing and heat treating, it is possible to minimize metallurgical defects in high-strength, heat-resistant alloys and resultant dimensional instability in finished parts.

The idea is a simple one: A combined heat treating and brazing operation not only cuts down on the number of heats that parts are subjected to—it also cuts down on the length of time that the parts must remain at elevated temperatures.

In other words, the fewer times today's tricky alloys are heated and reheated, the more likely they are to remain stable. Elimination of just one heat by combining heat treating and brazing has not only improved the physical properties of the finished assembly but has cut down on handling, requires fewer setups, produces fewer rejects, and has reduced overall processing time.

But there are problems, too—all the limitations that apply to brazing must now be added to those connected with heat treating. Combined brazing and heat treating just won't work unless the brazing alloy flows and makes good joints at temperatures suitable for heat treatment. Moreover, the brazing alloy and the parent metal must be compatible with the heat-treating atmospheres.

And the assembly must be so designed that the metal at the joint does not cause interference when it expands. As in all brazing work, joint design and preparation are critical—the brazing alloy must be positioned accurately and the joint must be clean.

Inter-related variables

For any given material, four variables must be considered: temperature, atmosphere, brazing alloy, and cooling cycle.

These variables are often inter-related. For example, our choice of the maximum heat-treating temperature for a material depends not only upon the properties of the material (as in a simple heat-treating cycle) but also upon the brazing temperature.

A brazing alloy must be found that is compatible with the heat-treating temperature and suitable for the temperature at which the part will eventually operate. Compromises are possible—often necessary—but whatever the temperature, time, and cooling rate, they must be held within close limits.

Let's look at type 440 stainless steel. Normally, this is copper brazed at about 100 F above the melting point of copper (about 1970 F). But the hardening temperature for 440 stainless is between 1925 and 1950 F. Thus, the usual brazing temperature of about 2060 F is higher than the hardening temperature.

In this case, brazing and hardening can be combined by bringing the

part up to brazing temperature and, when the braze has been made, droping down to the hardening temperature and holding there for the required time.

This doesn't work in all cases. For example, if the brazing temperature used for an AM 355 alloy assembly exceeds 1900 F, standard hardening steps may not be effective. Here selection of a brazing alloy becomes critical.

If we were to combine brazing and hardening of an AM 355 assembly and had chosen a brazing alloy that called for a brazing temperature of 1950 F, we would, once the braze had been made, have to bring the part back to room temperature, heat it to 1735 F, return it to room temperature again, heat it to 1710 F, and then cool it in the usual manner. This is neither simple nor economical.

To simplify the brazing and heat treating of AM 355, we use an 82%-gold, 18%-nickel brazing alloy with a brazing temperature of 1850 F. (Brazing temperature should be as close as possible to the hardening temperature of 1710 F). Once the braze is made, the assembly is cooled to 1710 F and held there for 30 minutes.

Furnace atmospheres

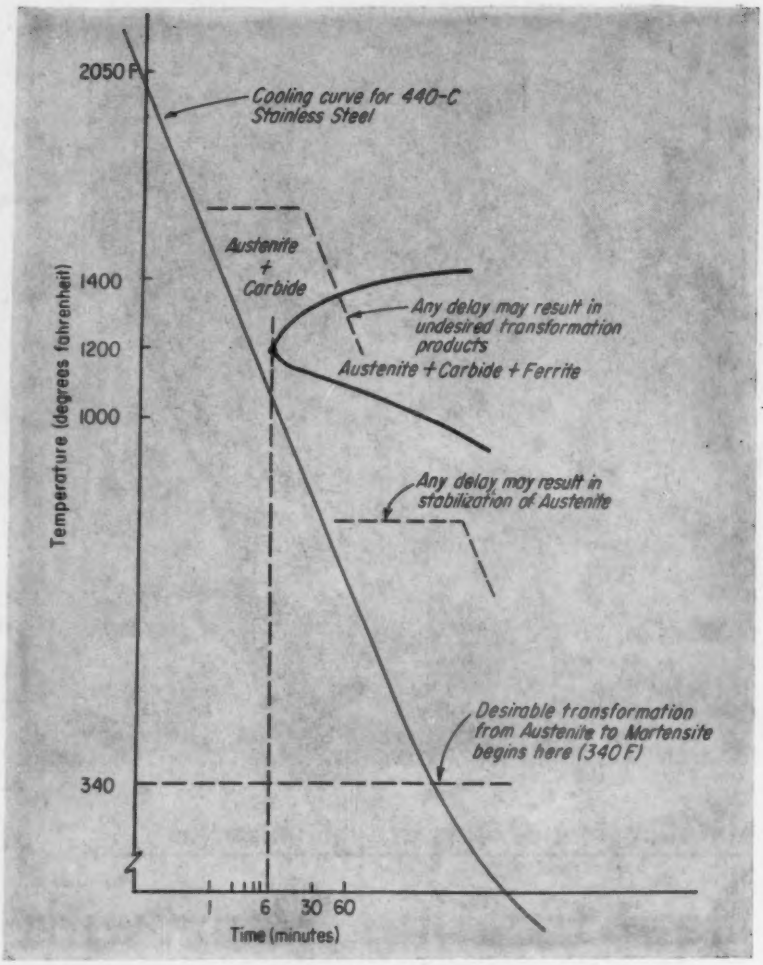
Some furnace atmospheres simplify the brazing operation. A reducing atmosphere, for example, tends to clean the joint surfaces, thus permitting a looser tolerance on pre-cleaning.

Hydrogen, depending upon its dew point, also exerts a cleaning action at temperatures of 1850 F and above. Type 440 stainless has been brazed successfully in a hydrogen atmosphere at —90 F dew point. Some grades of stainless, of course, are susceptible to hydrogen embrittlement; for these, a more inert gas (such as argon) is used. Inert atmospheres, however, have a limited cleaning effect and are more expensive.

Vacuum (in lieu of atmosphere) cleans very effectively and offers the advantages of hydrogen without the risk of embrittlement.

Cooling cycles

Cooling cycles are extremely important when dealing with materials that transform from austenite to martensite during hardening. "Stray" transformations must not be allowed to occur at elevated temperature, for such transformations yield a mixed structure—usually partially ferritic with various grades of fine pearlite



Time-Temperature-Transformation curve for 440C stainless steel shows critical importance of closely controlled, uniform cooling rate from brazing and hardening temperature down to room temperature and below. Work must cool to below 1200 F in less than six minutes for good results. Austenite transformation begins at 340 F

mixed in—and result in a loss of dimensional stability.

Cooling rates that might stabilize the austenite must also be avoided, for subsequent transformation of this material can result in a change in dimensions of the finished part.

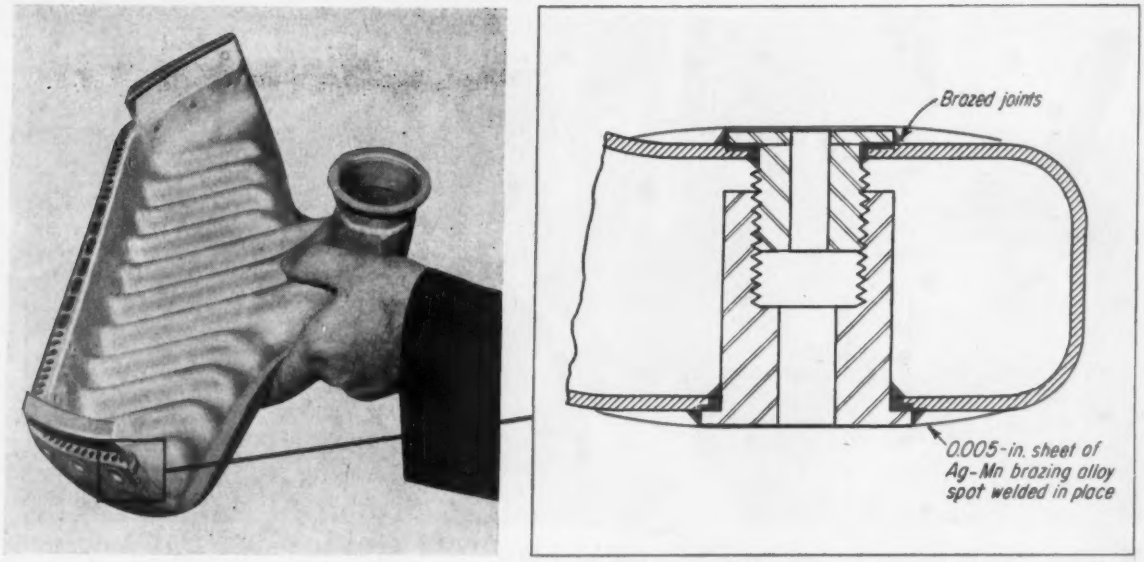
Typical combined operations

Brazing and hardening of Inconel X fittings in 17-7PH stainless-steel aircraft ducts (top, page 103) presented some interesting problems. Conventional heat treatment calls for 17-7PH to be heated to 1950 F, cooled rapidly to 1400 F, allowed to soak there for 1½ hours, and then cooled to 50 F. It may then be age-hardened at 950-1100 F, the exact temperature depending upon the physical properties desired.

Brazing of 17-7PH can be done at 1400 F or at 1950 F. Some low-melting-point silver brazing alloys are suitable for 1400 F, but the alloy content of 17-7PH is such that fluxes would be required.

The higher brazing temperature (1950 F) coincides with the hardening temperature. And at this temperature, hydrogen of very low dew point fluxes the sheet metal surfaces and reduces the cleaning problem. Several brazing alloys could have been used (and all were checked for compatibility with the part's end use), but we chose a silver-manganese alloy for brazing the fittings to the ducts.

We have also brazed and hardened an assembly of AM 350 tubing and 440C stainless castings. Brazing temperature had to be held below 1875 F; higher temperature tends to stabilize the structure of AM 350 and suppress its response to subsequent



Inconel X fittings are brazed to 17-7PH stainless duct by 0.005-in.-thick sheet of silver-manganese brazing alloy spot-welded in place before heating. Both hardening to 43 Rh C and brazing take place at a temperature of 1950 F

processing. Here we used an 82%-Au —18%-Ni brazing alloy at 1850 F.

Stainless servo valve

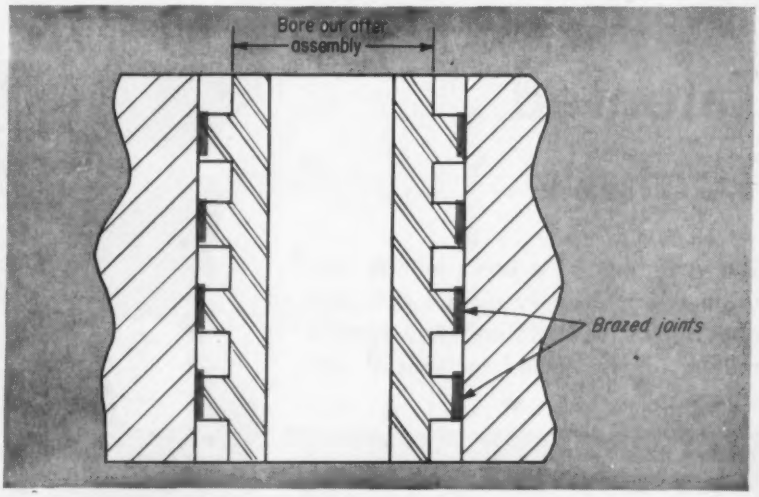
Another example of combined brazing and hardening involved joining a 440C stainless insert to a servo valve body of the same material. (See sketch at right.)

First, the insert was machined to produce a series of four flanges along its length, with the flange ODs fitting the bore of the valve body. This insert was then brazed (and hardened to 57 Rh C) in place in the bore. Later the body of the insert was bored out, leaving the flanges as a series of accurately located, concentric, brazed ID rings within the valve body.

Prior to brazing, we honed the joint surfaces (flange peripheries) to close tolerances and copper plated them to a thickness of 0.0002 in. Next, the inserts and valve bodies were assembled and placed in jigs designed to maintain alignment of the parts and to provide uniform contact and pressure of the joints during brazing.

Furnace load size was carefully determined to insure a cooling rate that would meet the requirements of 440C for transformation from austenite to martensite. We left considerable room around the parts because it is necessary in combined operations that the heat radiated by the parts be carried off as efficiently as possible.

We used hydrogen as the atmosphere, and to insure purity of the furnace atmosphere we purged with nitrogen and then hydrogen.

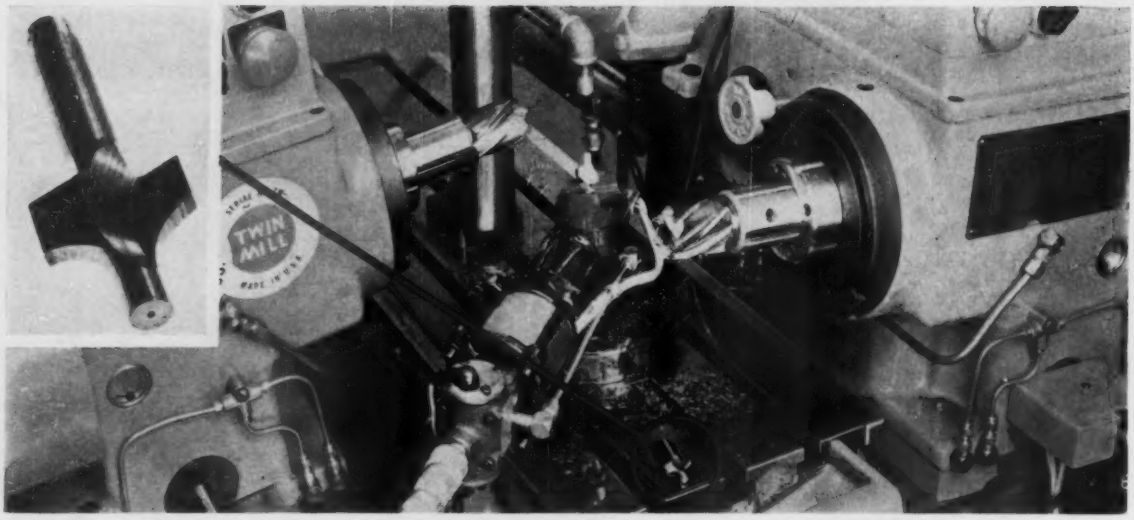


Tricky method of assembling hardened 440C stainless inserts in a servo valve body involves brazing a flanged sleeve into the bore of the body, then boring out the sleeve. Flanges remain as concentric rings in valve body. Brazing takes place at 2060 F, hardening to 57 Rh C at 1925 F—all in one operation

The parts were then loaded into the furnace, heated to 2060 F in about 40 minutes, allowed to soak there for 45 minutes, and then brought to the hardening temperature of 1925 F. To insure uniform temperature, we held the load at 1925 F for 45 minutes.

The cooling cycle had to be faster than the critical cooling rate if undesirable transformations were to be avoided. Cooling to below 1200 F in less than six minutes was adequate. (See Time-Temperature-Transformation curve, page 102.)

For valves that had to meet dimensional stability specifications, the cooling cycle could be continued to —100 F or even to —300 F. In some cases, the valve bodies were also subjected to alternate heating and cooling (400 F to —300 F) to remove any last traces of austenite that had not been transformed to martensite. This subsequent treatment insures maximum dimensional stability of the finished part. •

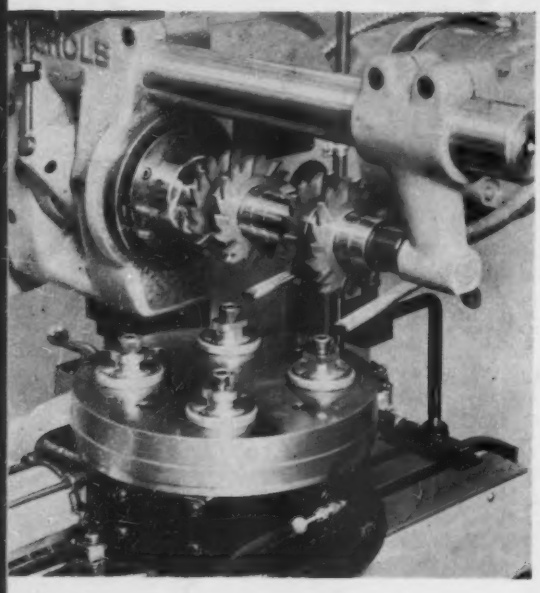


Milling wing-type flutes on HSS router bit . . .

Converging-feed milling heads engage workpiece at same time from opposite sides. Saddles of both milling heads have been tilted to produce proper flute angle. Blank is a screw-machine product that has been slabbed prior to being positioned in the air-actuated clamping fixture on the table of this Nichols Twin Mill. Saddle tilting is not a standard machine feature

Talented Tooling

The versatility of a basic milling machine is limited only by the skill that goes into its tooling. Here's how Nichols millers can be tooled for special jobs



Tricky contours on hand miller . . .

Roller bushing on shank of helical end mill rolls along a templet that is integral with the workholding fixture. Templet carries both top and bottom contours of the part, so operator of Nichols hand miller cuts top of one piece and bottom of another in one traverse of the templet

Continuous milling of squares . . .

Automatic indexing table presents each part to two pairs of straddle milling cutters, leaving two stations free for loading and unloading. Spindle downfeed, table feed, and indexing are synchronized. Two sides of a square are milled at each index on Nichols semi-automatic miller

Electronic teacher speeds work

The small screen in the picture to the right may someday be as familiar a sight on the assembly line as instruction sheets, which it replaces, are today. It's part of a teaching machine that synchronizes taped sound with projected color slides.

The system, called Audio Graphic, can cut assembly time, as well as rejects, significantly. And it has been designed by the maker (Graflex, Inc, Rochester, NY) to let the user do his own programming.

Basic component is the playback or instructor unit, which contains the screen, a tape deck, a 35-mm slide projector, speaker, and earphones. The user can take his own 35-mm slides, then record instructions for each assembly step through a programmer unit (at lower left). These instructions, recorded on magnetic tape, are synchronized with the slides by electronic impulses also put on the tape during recording.

Three types of operation are available: *continuous*—pictures and sound automatically change from step to step, without interruption; *demand*—the tape stops after each set of instructions, and is started again by the operator; *timed*—the machine automatically restarts after a predetermined time interval.

The instructor costs $695 and the programmer $195. The equipment may also be leased. •

Machinery orders to hit peak next spring

TOTAL MACHINERY

1960	Seasonally adjusted	Unadjusted	Pumps & Compressors	Engines & Turbines	Construction & Mining Mach.	Metalworking Machinery	Office Machinery	Other Ind. Machinery
I Q	169	177	327	161	193	168	220	154
II Q	180	184	321	180	197	175	227	161
III Q	176	168	296	139	159	176	216	149
IV Q	162	158	303	128	138	179	221	136
1961								
I Q	165	173	331	134	157	212	242	145
II Q	176	181	296	137	164	223	243	159
III Q*	179	171	276	121	151	191	246	156
IV Q*	180	175	281	130	144	196	264	159
1962								
I Q*	182	190	299	140	170	230	270	169
II Q*	188	193	309	148	167	248	271	170

*Forecast made in mid-July, 1961. (1950 = 100)

Capital goods manufacturers predict that their new orders will continue to rise steadily through the remainder of this year and on into next. The current forecast of 188 (1950 = 100) for the second quarter of 1962 is an all-time high for new machinery orders.

Manufacturers in all six non-electrical machinery categories covered by this latest McGraw-Hill Machinery New Orders Forecast are predicting gains. Metalworking machinery builders expect orders in the fourth quarter of 1961 to reach 196 (1950 = 100), first-quarter 1962 orders to hit 230, and second-quarter orders to climb to 248.

Office machinery manufacturers predict April-June 1962 orders will be 12% higher than in the same period of this year, and engine and turbine manufacturers anticipate an 8% rise in the same period. New orders for other industrial machinery—general and special-purpose industrial machinery—are expected to be 7% higher in the second quarter of 1962 than in the comparable quarter of this year. •

Press brake forms to ± 0.005 inch

By Roland J Casey, methods planner
Heavy Military Electronics Dept
General Electric Co
Syracuse, N Y

Forming of sheet metal parts on a press brake is difficult to say the least, when (1) tolerances must be held as close as ±0.005 in., and (2) when production is low.

Reason is that commercial tooling is simply not geared to such tolerances, nor are tool alignment and gaging accuracies.

Obviously, in working with such tooling, the only way to achieve precision bends and to avoid assembly difficulties caused by mislocated mounting holes pierced in the flat is to isolate five probable sources of error in forming:

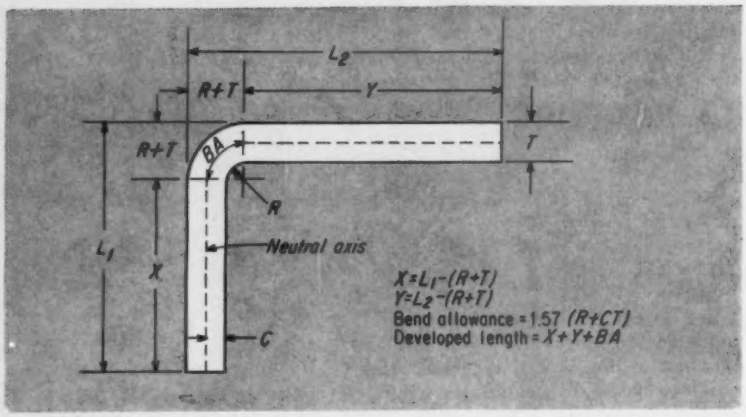
- Material tolerance
- Bend-allowance development
- Required radius on the part
- Alignment of punch and die
- Accuracy of the gaging device on the press brake

The first two items must be considered together, because the bend-allowance formula for a 90° bend equals 1.57 ($R + CT$). Here C is an empirical constant based on the assumed location of the neutral axis of the bend and T is the material thickness.

The effect of T can be shown by an example. If 0.180 in. material is substituted for 0.187 in. stock, an error of only 0.005 in. is introduced in the bend allowance. For two bends in the same plane, the developed length is in error by 0.010. And the value of C, as used in industry, ranges from 0.3 to 0.5. According to our tests, the correct value of C is 0.4. In any event, commercial-tolerance material is satisfactory for close-tolerance bends.

Larger source of error

A much more important source of error is the difference between the calculated radius and the actual radius of a bend. The bend allowance is changed by the factor 1.57 or 1½ times the difference in radiuses. For example, a part made from 0.125 in. material checked out to a 0.170 in. radius, not the 0.187 in. calculated radius. The change in bend allowance amounted to 0.027 in. For two bends, a 0.054 in. error is transmitted to the finished product.



Developed lengths of all samples were computed so that L_1 and L_2 would equal 1.000 in., or a sum of 2.000 in., after forming. Errors attributed to the back gage did not affect the bend-allowance calculation

Numerous tests were made to determine how to control radius. In some tests, standard punches and V dies were used, but the die opening was varied between 6 and 10 times stock thickness. In other cases standard V dies were used with oversize-radius punches.

For example, punches up to a 0.218 in. radius were used to obtain a true 0.187 in. radius in 0.125 in. aluminum. Finally, standard punches were used with special-radius bottoming dies. These dies were made to the exact contour of the finished parts.

Full-radius dies

For instance, if ⅛-in. aluminum stock was formed to 90° with a 0.125 in. radius, the die would be 89° –90° with a full 0.250 in. radius. In both of these cases different die openings (6 to 10 times material thickness) were also used.

After checking the radius on an optical comparator and analyzing the results, these conclusions were reached.

- Radius bottoming dies should be used on all material over 0.093 in. in thickness. (Material less than 0.093 in. thick has a greater tendency to wrap itself around the punch to form a true radius; hence a radius bottoming die is not necessary).
- The die opening should equal 8 times the material thickness. This value will necessarily be deviated from whenever the flange heights are very small or when holes exist near the bend line.

During the course of this investigation, it was discovered that misalignment of the die and punch existed.

Because of friction between the heavy bolster and the bed of the press brake, misalignment errors of 0.004 to 0.021 in. resulted, and were naturally reflected in the parts.

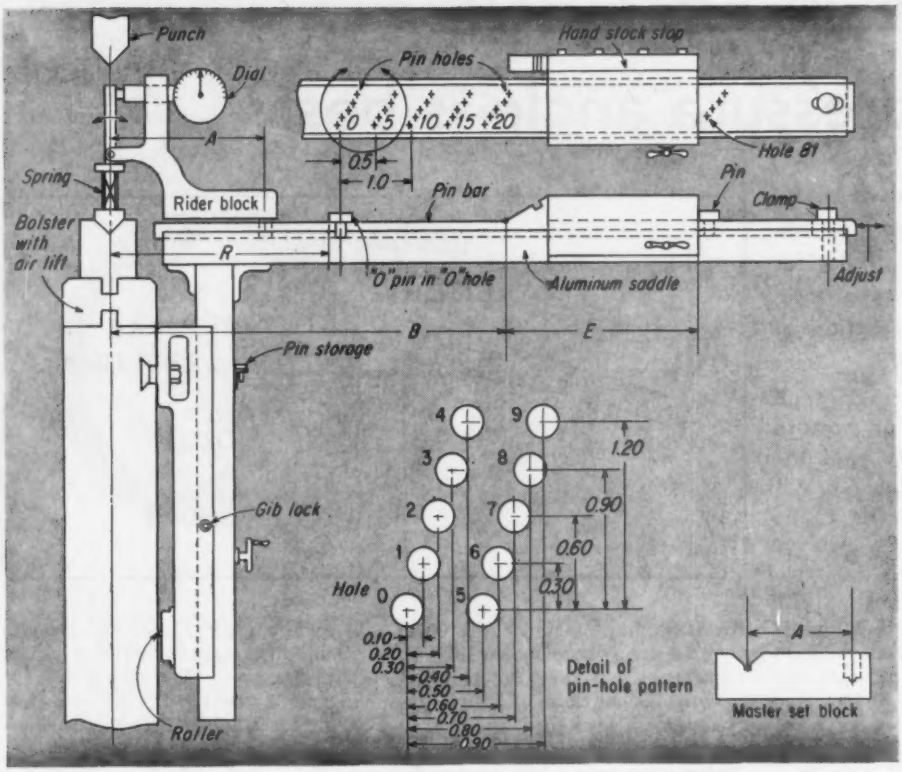
To minimize these errors, an air-lift system was devised to reduce friction between bolster and bed.

Now, in setting up, all the operator has to do is to switch his air lever to open just before he brings the punch and die into direct contact. This method has reduced the misalignment of punch and die to less than 0.001 in. without increasing set-up time.

Pin gage for press brake

The original system for setting the back gage made use of a steel square and a triangular block with a datum mark. The block was placed in the die, and measurements were made from the datum line on the supposition that it coincided accurately with the centerline of the die and punch. Therefore, any misalignment of the punch and die added to the errors inherent in this method of setting the back gage.

We needed a method of setting the back gage (with respect to the bend line) within 0.010 in. This accuracy is now assured with a special pin gage consisting of a pin bar drilled with a pattern of holes, so that the distance from the centerline of one hole to the next equals 0.100 in. Finer increments are obtained with 10 gage



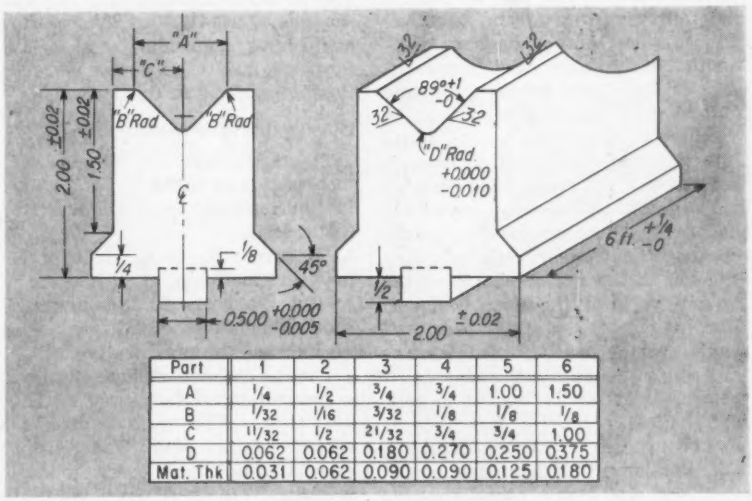
Hole pattern in pin bar and set of ten pins with stepped head diameters makes it easy to set pin gage for accurate location of precision bends

pins with head diameters ranging from 0.500 to 0.320 in. by 0.020 in. increments. For purposes of measurement, these pins give 0.010 in. increments.

Set-up procedure

To zero the pin gage, this procedure is followed:

- Loosen the bolster, apply air lift and lower punch into die. Tighten bolster, raise ram. Now the punch and die are aligned.
- Elevate the saddle so that the pin bar is approximately in line with the top of the die. (A spring eliminates need for a fine adjustment on the saddle height).
- The setting fixture consists of a rider block with pin (to engage a reference pin hole in the pin bar), a spring-backed dummy punch on a pivoted lever, and a dial gage. Dimension *A* is set with the master set block, and the dial is set to zero.
- The pin bar is unclamped so that it slides freely in the aluminum saddle. Now, the rider block is installed on the pin bar and the whole unit is adjusted right or left until the dial registers zero, and then the unit is clamped.



Part	1	2	3	4	5	6
A	1/4	1/2	3/4	3/4	1.00	1.50
B	1/32	1/16	3/32	1/8	1/8	1/8
C	11/32	1/2	21/32	3/4	3/4	1.00
D	0.062	0.062	0.180	0.270	0.250	0.375
Mat. Thk	0.031	0.062	0.090	0.090	0.125	0.180

Special-radius bottoming dies were used with standard punches

The pattern of pin holes is such that if pin "O" (0.500 in. head dia) is placed in hole "O", the back gage is on the centerline of the die. Dimension *R* is pre-established to create this condition, and equals dimension *E*.

Now suppose we set the back gage to 8.19 in. from the die centerline. This is dimension *B*. The coarse adjustment equals *B* divided by the hole spacing, or 8.19 ÷ 0.100 = 81. So we select pin hole No. 81. To get the remainder (or fine measurement of 0.009 in.), we select pin No. 9 (head dia. = 0.320 in.) Now we can be certain that the first piece will be formed accurately. •

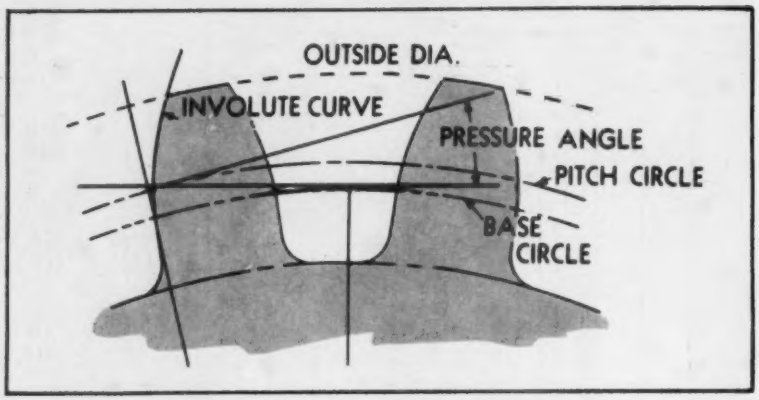
For smoother operation and longer gear life

Which pressure angle is best?

Gear selection involves many variables. One of the most important is pressure angle, for it affects the wear resistance, strength, and tooth action of the gear.

Here are some tips on how to choose between 14½° and 20° pressure-angle gearing

By Frank J Rankar, engineer,
Ohio Gear Company, Cleveland, Ohio



"When in doubt, select a 20° pressure-angle tooth." This axiom, well known in the gearing industry and among gear users, will seldom lead you astray, but it isn't always the best solution for a specific gear-design or gear-replacement problem.

First, let's look at what we mean by pressure angle when we're talking about gears. By definition, the pressure angle of a pair of mating involute spur gears (and here we will discuss only standard, full-depth, conventionally cut spur gearing) is the angle between the line of action—a line drawn tangent to the base circles of the gears—and a line perpendicular to the line-of-centers of these gears. (See sketch.)

For years, involute spur gears have had a 14½° pressure angle, mainly because the trigonometric relationships of such a system simplified the layout work of the gear designer. But in recent years 20° pressure-angle gearing has been growing increasingly popular, until today 14½° gearing is generally limited to spur and helical gears cut for replacement purposes, for gears requiring the maximum length of line of action, and for a few other applications.

Stronger, more wear resistant

One reason for the popularity of 20° pressure-angle gearing is that it provides a gear tooth that has from 14 to 21% greater beam strength. (Tooth strength is determined as if the tooth were a cantilever beam subjected to a concentrated load.) Strength alone, however, cannot be the determining factor in gear selection, for it has been shown time and time again that wear, not breakage, is the principal cause of gear failure.

The wear resistance of 20° pressure-angle gears is considerably higher than that of 14½° gears. Depending upon material and hardness, 20° gears will show from 20 to 40% higher wear resistance.

Carefully cut spur gears, whether they have a 14½° or 20° pressure angle, have an efficiency of 95 to 98%. So there is little to choose between the two systems on this basis.

How to improve tooth action

There are four ways to improve tooth action in gears:

1) Shorten the tooth height (stub tooth design).
2) Undercut the tooth flank or relieve the tooth tip.
3) Cut the gears to the long-and-short-addendum system.
4) Increase the pressure angle.

Though any one of these steps will improve tooth action, they all have drawbacks. The stub tooth has a shorter contact path. Undercutting, especially on small gears, tends to weaken the tooth. Tip relieving calls for special tooling. And changing the addendum on the mating gears amounts to cutting special gears.

The simplest, most practical way to eliminate interference is to go to 20° pressure-angle gearing. This does not apply, however, when small-diameter supporting shafting is used, for 20° gears have a greater separating force and this would tend to increase shaft deflection.

Undercutting is often necessary to avoid interference between gears with few teeth. For such gears, the increased strength of a 20° pressure-angle tooth helps offset the weakening effect of undercutting.

Contact ratio is important

Good gear design with smooth tooth action commonly calls for at least 1.4 teeth in contact at any given time. This is expressed as a contact ratio of 1.4. (Contact ratio indicates how many teeth are carrying the load.)

In gear combinations involving a large number of teeth, 14½° gears inherently have a higher contact ratio, thus spreading the load over a greater number of teeth. But in gear sets with a 1:1 tooth ratio (equal number of teeth in the mating gears) the desirable 1.4 contact ratio is approached more rapidly with 20° gearing.

For example, a pair of 14½° gears must have 23 teeth each to achieve the 1.4 contact ratio; a pair of 20° gears would need only 14 teeth each.

With 1:1 tooth design, the contact ratio is about equal (1.601 for 20°, 1.599 for 14½° pressure angle) when the mating gears each have 24 teeth. With an increase in the number of teeth, the contact ratio favors 14½° gears.

Standard 20° pressure-angle gears that are interchangeable with 14½° sets are available. In some cases it is possible to switch from 14½° gears to 20° gears in existing machines and get 14 to 21% greater load-handling capability. •

Each apple in a barrel may appear identical (or every ball bearing may look alike, or every hole seem the same diameter) yet some will vary from the norm. This difference ("standard deviation") can be figured out and expressed in a single number. It is possible to make decisions based on only random samplings if you . . .

MEET MR. SIGMA

By W F Conroy, General Electric Co, West Lynn, Mass

The very mention of statistics often causes many of us to run and hide in real fear. Actually, the basic methods of statistics are easy to understand, and require no more than grammar-school arithmetic to follow through.

And there is one quantity—which we can figure out for any set of samples—that is of extreme importance to anyone who ever uses random sampling. (This ranges from sampling wine before it is served, on up to projecting a small cross-section of opinion into a full-scale Gallup poll.)

This single number is so important that we have given it a name—Mr Sigma. And Mr Sigma *all by himself* can tell us almost everything we need to know about the various members of any given set of data.

To start getting to know this fellow, let's assume we have a barrel full of eyeballs—or ball bearings or marbles, if the idea of eyeballs isn't appealing. What we are going to do first is to see if we can find out (on the average) what size the eyballs are, and then attempt to figure how close (also on the average) any given eyeball can be expected to match this value.

Suppose now that we take 50 eyeballs at random, and measure the diameter of each. We might get the following measurements:

1.005	1.004	1.003	1.006	1.005
1.006	1.005	1.004	1.007	1.007
1.007	1.009	1.005	1.003	1.004
1.006	1.007	1.006	1.007	1.005
1.008	1.005	1.004	1.008	1.004
1.006	1.004	1.002	1.005	1.003
1.007	1.006	1.006	1.005	1.004
1.005	1.008	1.003	1.005	1.003
1.010	1.005	1.002	1.002	1.007
1.001	1.004	1.006	1.004	1.005

Now let's get the average. We add up all our measurements (this gives 50.258) and divide by the number of measurements (50). The result is 1.0052 (or 1.005 to keep within the thousandth magnitude). Therefore, we would say that the average eyeball has a 1.005-in. diameter.

This is a statistical method. However, in statistical language, the same technique is stated as: "The arithmetical mean of the diameter of an eyeball can be derived by dividing the summation of the measurements of elements examined by the number of elements." Mathematically, the hog-wash is expressed as

$$\overline{X} = \frac{\Sigma xf}{N}$$

This equation, although it looks quite complex, is really quite simple, and is just a symbolic shorthand for stating something that otherwise requires a lengthy explanation. Let's look at it.

The first symbol, $\overline{X}$, is merely another way of expressing the term popularly called average, and precisely called arithmetical mean. The next symbol (Σ) is the Greek capital letter sigma, which would be a capital S to us. It stands for summation, and simply means to add up whatever follows it.

For example, Σxf means simply to first multiply each element x by its corresponding number f, and then to add up. Simple, isn't it?

Now, then, let's refer back to the measurements we made above. At first glance, we notice a disorderly group of figures. However, let's re-arrange the listing to put the measurements in order according to size; in statistical language, let's "array them."

Array of Eyeball Measurments

1.001	1.004	1.005	1.006	1.007
1.002	1.004	1.005	1.006	1.007
1.002	1.004	1.005	1.006	1.007
1.002	1.004	1.005	1.006	1.007
1.003	1.004	1.005	1.006	1.007
1.003	1.004	1.005	1.006	1.008
1.003	1.004	1.005	1.006	1.008
1.003	1.004	1.005	1.006	1.008
1.003	1.005	1.005	1.007	1.009
1.004	1.005	1.005	1.007	1.010

These figures are the same as those originally recorded; the only difference is that they are now in numerical order. And, we can plot them on a graph (next page).

This chart is called a *histogram*. Call it a chimney chart if you like—the important thing is its general shape.

Before commenting on this shape, let's try another example. Let's determine the height of some yogis. We will take fifty samples as before. However, so that we can save a little space, we will arrange the meas-

urements in an orderly array as we record them. The readings might be:

4 ft, 4 in.		4 ft, 7 in.		4 ft, 8 in.		4 ft, 9 in.	
4	4	4	7	4	8	4	9
4	5	4	7	4	8	4	10
4	5	4	7	4	8	4	10
4	5	4	7	4	8	4	10
4	6	4	7	4	8	4	10
4	6	4	8	4	9	4	10
4	6	4	8	4	9	4	11
4	6	4	8	4	9	4	11
4	6	4	8	4	9	4	11
4	7	4	8	4	9	5	0
4	7	4	8	4	9	5	1
4	7	4	8				

The height of a yogi is the average of these measures. Add them up (Σx) and divide by the total number ($N = 50$) of measurements taken.

$$\frac{200 \text{ ft, } 400 \text{ in.}}{50} = 4 \text{ ft, } 8 \text{ in.}$$

Hence, the average height of a yogi is 4 ft, 8 in. Without worrying about it, we have done exactly what the formula for arithmetic mean says:

$$\overline{X} = \frac{\Sigma x}{N}$$

Finally, let's make a chimney chart or histogram for yogis (right). Look at this chart, and compare it with the one we made previously for eyeballs. Any similarity? Sure there is! But this most certainly does not mean that eyeballs and yogis are alike. It does mean, however, that their patterns are similar.

For that matter, would you expect the diameter of onions in a 5-lb bag to also plot into a similar pattern? They probably would. How about the dimensions of workpieces being produced on a machine? Or the variations in bores machined in job shops on dissimilar items. All of these will fit the patterns.

Evidently, there must be something significant about the shape of this pattern of measurements from a group. Studies of these patterns have been made, and we shall discuss these a little later.

First, let's look back a minute. We have seen that finding the average ($\overline{X}$) is a relatively easy task. However, would you be surprised if someone asked: "What average are you talking about?" You would easily reason that maybe more than one average must exist. This is true.

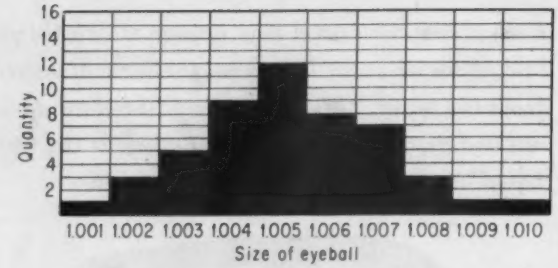
Several averages have been defined, and there are methods of finding the different types. We shall confine ourselves to describing only three: the arithmetic mean, the median, and the mode.

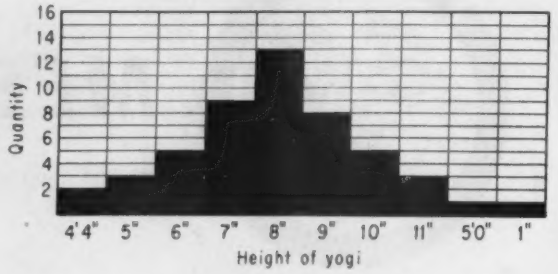
The arithmetic mean (what we have called the popular average, or $\overline{X}$) is by far the most difficult to find. We did this without too much trouble.

The median is merely the middle element in an array. You can locate this fellow very quickly by looking at the orderly arrayed columns of eyeball sizes or yogi heights. With 50 measures for each, the median will be between the 25th and 26th measure. For eyeballs the median is 1.005; for yogis it is 4 ft, 8 in.

Let us look at the mode, sometimes referred to as modal average. This guy, for all his fancy name, is only the measure or element that occurs more frequently than any other. He can be found by glancing at the chimney chart or histogram—the tallest smoke stack is the guilty one. The modal average, or merely mode, is 1.005 in. for eyeballs, and 4 ft, 8 in. for yogis.

Up to now, we have been looking at averages from





only one point of view—that of size, or height. Even the median fell in the highest column in the histograms.

This approach is important. Equally important, however, is how close to the arithmetic mean ($\overline{X}$) each element falls. This relationship comes under the heading of Measurement of the Masses, or Dispersion.

What we mean is this. No one really expects every element to fall exactly at the average, so we must ask: "How close does each element come to the average?" This determines the width of our histogram, or the shape of a clothesline strung across the chimneys.

The clothesline will take the shape of a bell over its length. However, the bell can look fat and stubby—almost like the famous Liberty Bell—or it can be slender like the bells hung on Christmas trees. A few typical histograms, with their associated clotheslines or bell shapes, might look like this:

The shapes of these bells show us how the elements (x) cluster around the mean ($\overline{X}$). The fat one shows wide dispersion of elements; the skinny one reveals close dispersion.

If we presume that the average ($\overline{X}$) lies at the peak, and we use this to state the size of eyeballs and the heights of yogis, are we lying? The eyeball, we said, is 1.005. If one measures 1.001 or 1.015, would this mean that our statement is false?

I think we can accept the fact that occasionally one element will fall far to the left or right. The average American soldier's height is 5 ft, 10 in. If a soldier of 5 ft, 0 in. or one of 6 ft, 2 in. walked by, would you suspect that our statistics are wrong? I doubt it.

I think that you will readily realize that these men are in the minority, or at the ends of our curves.

Returning once more to our barrel of eyeballs, you will recall that we made a definite statement about their size. However, we measured only 50 of them, and a standard trash barrel will hold many, many more than 50 eyeballs, probably several thousand. Think

about what might happen to the *shape* of our bell curve if we measured all the eyeballs, and plotted them.

Do you think that the general shape of the bell would change much? Do you think the shape might approach a well contoured bell? Probably so. Doesn't such a theory lend itself to the possibility that a relatlvely few measurements can tell us something about the remaining unmeasured eyeballs?

Certainly it will. And, in Quality Control we refer to this technique as sampling.

Sampling is an old technique, and each of us is familiar with it—although we may not have given it such a formal name.

Did you ever steal a grape from the fruit stand? Why? Obviously, you did it because you wanted to steal a grape. But if the grape was lousy, you condemned the rest. If the grape was normal, you probably felt that the rest were about "average" for a grape. And, if you really enjoyed it and your taste glands spilled, you probably purchased a pound or so. You sampled, and concluded that the rest would be alike.

In theory, this sampling is no different from the one we are talking about. Suppose we could measure the scattering of our measurements for eyeballs around the average—on a percentage basis. Then, if we know that 10% of the eyeballs are .003 below the average (X) a reasonable conclusion might be that 10% of the eyeballs remaining in the barrel are also .003 below 1.005 in. (with diameters of 1.002 in. or less).

If the barrel contained 2000 eyeballs, we would expect 200 of them to measure 1.002 in. or below. Of course we haven't proved anything.

However, a mathematician named Poisson studied these bell shapes. He defined the shape as a "normal" curve and studied it with the tools of higher math.

Poisson stated—and then proved mathematically—that we can find out how many of our measurements fall below the average and how many fall above the average, and how prone they are to hover around the average. The shape of the curve determines the percentages for each group size. Let's take a look.

We want to examine the deviation of the elements—that is, we would like to try to find some measure of how far each element differs from the average. First, let's examine a set of measurements, and figure out the difference between each element and the popular average. This might give us some idea about the spread, deviation, or whatever we elect to call this variation of individual elements. Try it with some eyeballs.

Average	*Element*	*Difference*
1.005	1.001	.004
1.005	1.004	.001
1.005	1.005	—
1.005	1.007	–.002
1.005	1.010	–.005

This should be enough to get across the idea. If we calculate the difference for all 50 elements, can we get any useful information? Let's see. All the plus figures in the difference column add to +0.032, and all the minus figures in the same column add to –0.040.

If we add these two algebracially we get a total of –0.008, and dividing by 50 gives –0.00016. This is the average difference from the arithmetcial mean for our eyeball readings. Does this mean, then, that the figure 0.00016 represents the difference from $\overline{X}$ that the measures have? *The answer is no.*

What is wrong? The truth of the matter is that *in cancelling the plus and minuses, we cancel the value of the data that we struggled to obtain.*

It looks like, then, that in order to use our data, we must get rid of the minus signs in the difference column. We can't ignore them, so let's square each one, add them up, and take the square root as a result.

Here's the way a few of the calculations would go:

Average $(\overline{X})$	*Element* (x)	*Difference* (d)	*Difference squared* (d^2)
1.005	1.001	0.004	0.000,016
1.005	1.004	0.001	0.000,001
1.005	1.005	—	—
1.005	1.007	–0.002	0.000,004
1.005	1.010	–0.005	0.000,025

If we add up a complete difference squared column, we get 0.000,176 (Don't stop to do all this work, it's done for you at the end of the article. Dividing this by 50, which is the number, N, of readings, we have 0.000,00352. Is this our average difference from $\overline{X}$? Not quite. We squared the difference, remember?

$$\sqrt{.00000352} = .00187, \text{ say } .0019$$

Should the sign be considered? Yes. This number, .0019, is plus or minus, since it is a square root. Therefore, this number shows us, on the average, how far to the left and right of center our measurements fall.

This number is so important that we give it a name. We ca'l it little sigma—written σ. Before we see why Mr. Sigma is so important let's look back at how we found him. Using mathematical shorthand, we can concisely write down the steps to find Mr. Sigma:

$$\sigma = \sqrt{\frac{\Sigma d^2 f}{N}}$$

Don't let this bother you. Here's all it says: To calculate little sigma, first add up the number (f) of diffences squared (d^2); second divide this by the number of elements (N); finally, take the square root.

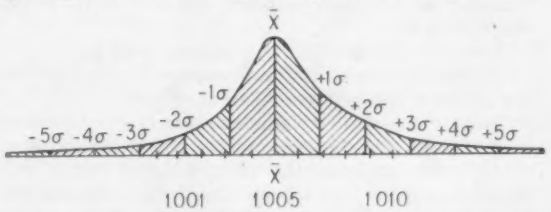
Now let's really get to know Mr. Sigma. The symbol σ is the way mathematicians write a quantity called the *standard deviation.* It is easy to see—in the light of how we discovered this quantity—why it is so named.

Little sigma (σ) has the most important job in statistics. It describes the breadth of a curve.

Let us look at the meaning of sigma (σ) by examining a curve which represents the distribution of eyeball measures (see below). Recall that, for eyeballs, the low reading was 1.001, the average $(\overline{X})$ was 1.005; and the highest reading was 1.010. We found sigma (σ) to find out something about the relationship of individual readings. Let's see what Mr. Sigma says.

Sigma, the standard deviation, is 0.0019. Therefore, we will add and subtract this from the average, and add lines to our graph below. Doing this several times, we get the series of vertical lines shown on it.

Looking at this chart, you will quickly note that each interval of sigma, out from the average, encompasses less and less and less of the area. The curve keeps getting closer to the base line, but never touches it.



We see that the greatest areas—hence, the greatest number of measures—falls within the region of $\pm 1\ \sigma$. There is little beyond three sigmas on either side.

Statistical Work Sheet

1	2	3	4	5	6	7	8
X	f	$X \cdot f$	$\bar{X} = \frac{\Sigma X \cdot f}{N}$	$d = (\bar{X} - X)$	d^2	$d^2 \cdot f$	$\sigma = \sqrt{\frac{\Sigma d^2 \cdot f}{N}}$
1.001	1	1.001		.004	.000,016	.000,016	
1.002	3	3.006		.003	.000,009	.000,027	
1.003	5	5.015		.002	.000,004	.000,020	
1.004	9	9.036		.001	.000,001	.000,009	
1.005	12	12.060		—	—	—	
1.006	8	8.048		−.001	.000,001	.000,008	
1.007	7	7.049		−.002	.000,004	.000,028	
1.008	3	3.024		−.003	.000,009	.000,027	
1.009	1	1.009		−.004	.000,016	.000,016	
1.010	1	1.010		−.005	.000,025	.000,025	
Totals	$N = \Sigma f$ = 50	$\Sigma X \cdot f$ = 50.258	$\bar{X} = \frac{50.258}{50}$ = 1.005			$\Sigma d^2 \cdot f$ = 0.000,176	$\sigma = \sqrt{\frac{0.000,176}{50}}$ = .00019

This form—filled in for one of our eyeball examples—is designed to take much of the work out of the calculation of sigma, or standard deviation. The mathematical formulae and symbols are listed at the top of each column; here are some comments on what we actually do:

Column 1: In this column all the *different* measurements are inserted. You may list them numerically in sequence of units—such as 1, 2, 3, 4, etc—or you may list them according to your actual data—such as 3, 1, 2, 4; either method is satisfactory. Note that we do NOT list every individual reading; we only list every numerically different reading.

Column 2: we don't want to omit any readings, so in this column we list the number of times each individual reading occurs. *This is the column that saves paperwork and fingers from pencil squeezing.* For example, if the readings were 1.003, 1.003, 1.003, 1.003, 1.003. In column 1, look for the 1.003 box; then, in Column 2, write the digit 5 next to it. The f means frequency, and it refers to the number of times each element x occured.

Column 3: This column sums up the data. It is obtained by multiplying each element in Column 1 by its corresponding frequency in Column 2.

Column 4: Here we obtain the popular average $\overline{X}$, or mean. All we do is follow the formula and divide the *total* of Column 3 by the *total* of Column 2.

Column 5: All that is necessary here is to record the difference—for each entry—between Column 4 and Column 1. Always subtract Column 1 elements from those in Column 4, *being sure to include the plus or minus sign.* The result can be zero, and if it is, don't worry.

Column 6: Get rid of those minus signs! Take each element in Column 5, square it, and write the answer here.

Column 7: Column 6 didn't take the frequency of elements into consideration. So multiply each element in Column 6 by the corresponding element in Column 2 and record your answer here.

Column 8: All this work was performed to get sigma, and here is where we record it. Merely divide the *total* of Column 7 by the *total* of Column 2, and take the square root.

We have plodded along slowly to get there. Actually, the work involved in calculating sigma is much less difficult to perform than to talk about. Try it, using the Statistical Work Sheet.

Other Uses

To determine:

Median averages: 1) Add Col. 2.

2) Divide this answer by 2, and then add up Column 2 line by line until this mid-point is reached or passed.

3) In Column 1—opposite the mid-point—is the median. (Median is 1.005 in above example.)

Modal average: The largest figure in Column 2 is opposite the modal average in Column 1. (Mode is 1.005 in above example.)

Histogram: Plot a chimney height for each element of Column 2.

The area under each of these different segments of the curve can be calculated, and tables exist in many books. However, for our purposes, it is enough to know that

$\pm 1\ \sigma = 68\%$ of all elements
$\pm 2\ \sigma = 95\%$ of all elements
$\pm 3\ \sigma = 99.7\%$ of all elements

Thus, for all practical purposes, $\pm 3\ \sigma = 100\%$ of the measurements

This is Mr. Sigma! But how can he help us?

Mr. Sigma's size is very important and, as a rule, the smaller he is the better we like it. Why?

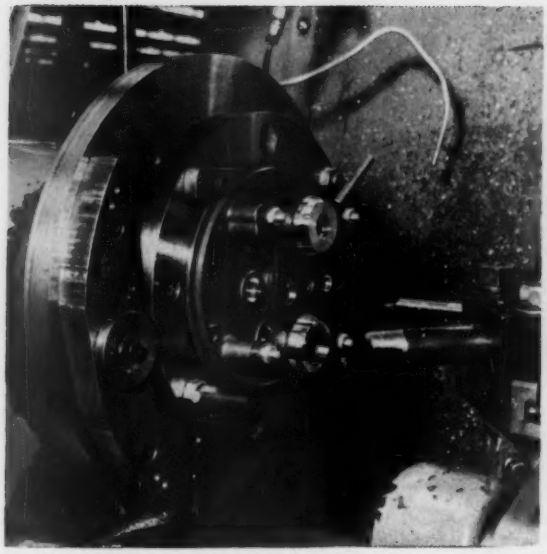
Compare the size of sigma *relative to the tolerance* for a certain part dimension. If sigma is the same as the tolerance, we know that about 2 out of 3 parts will be within size; if sigma is one-third the tolerance, we know that only 3 in every 1000 parts will be out of size. See why we want him to be little?

Looking at things from a different angle, we should see that it is rather important to know sigma for a certain process *before we set tolerances*, because Mr. Sigma gives a very close count of the reject rate.

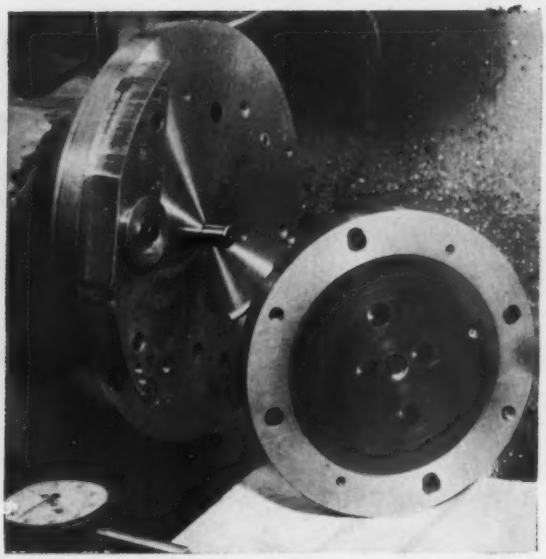
If you set a tolerance that is the same as the standard deviation (sigma), you can expect to reject about one part in three, whereas increasing the tolerance to twice sigma will cut rejects to one in 20. In other words, Mr. Sigma can tell us how much to increase an order if we want to be sure to make enough acceptable parts.

It's also easy to see that we might be able to use Mr. Sigma to tell us which machine to use in order to maintain a certain tolerance, or whether a given machine can maintain it at all. As a matter of fact, knowing Mr. Sigma is the key to understanding most of the methods of calculating machine capability. But this is another subject.

When you want to find Mr. Sigma for a given set of data, you might be interested in the accompanying Statistical Work Sheet, which gives a systematic way of computing the standard deviation. •



Transfer jig plates and centering faceplate make it possible to rough and finish holes within ±0.0001 in. of size on small, precision turret lathes



Holes in back face of transfer plate locate over hardened pin in baseplate to align hole to be machined with axis of lathe spindle. Counterweights balance the fixture

Jig boring on small turret lathes

By John Dow, superintendent of manufacturing,

and Clarence Mathewson, staff engineer—production engineering,

Aeronautical Div, Minneapolis-Honeywell Regulator Co, Minneapolis

When your jig borers are being used full-time and you come up with additional work that calls for jig borer accuracy, what do you do? If the additional work is sufficient to justify another machine, the solution is clear. But what if the new work load isn't that heavy?

We faced just this problem in machining the many small aluminum and magnesium castings used in our aircraft and missile control devices. Holes had to be held within tolerances of ±0.0001 in. for size and within ±0.0002 in. for center location, but the work load wouldn't justify another machine.

Fixture for turret lathe

Our solution was to develop special jig-boring fixtures that could be mounted on the faceplates of Hardinge turret lathes and chucking machines. These fixtures made it possible to bore the holes within the allowable tolerances, at a cost equal to or less than doing the job in a conventional jig-boring setup.

Each fixture consists of two subassemblies—a baseplate which bolts to the faceplate of the lathe, and a work-locating-and-clamping transfer plate. The baseplate is a disk of unhardened mild steel, equal in diameter to the faceplate on which it is to be mounted, with opposite faces ground flat and parallel with each other.

Locating pin

In the center of the baseplate is a ½-in.-dia locating pin that projects approximately 1 in. from the front face. This hardened, ground, and lapped pin must be perfectly perpendicular to the face of the baseplate, for this pin aligns the hole to be machined with the axis of the lathe spindle.

Around the outside of the baseplate, holes are drilled, countersunk, and tapped to provide for the mounting of a counterbalance.

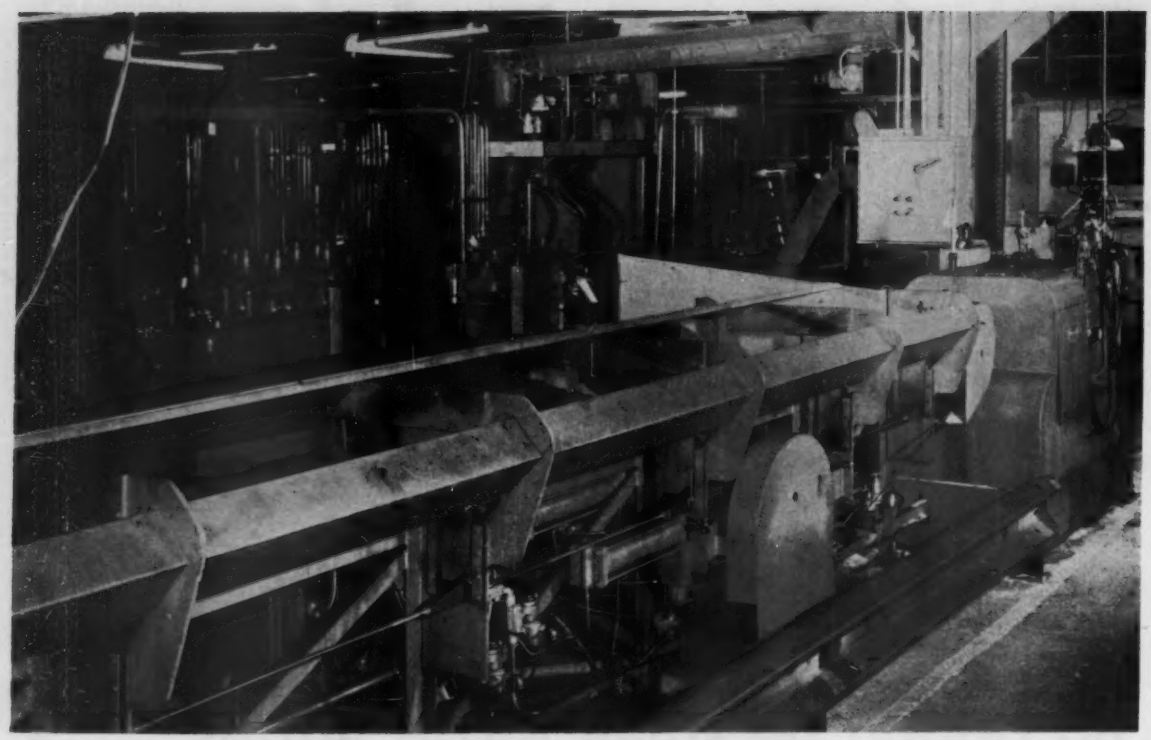
The transfer plate, the second member of the fixture, is a 1-in.-thick disk of tool steel, hardened and ground all over. In its back face are ½-in.-dia, ground and lapped locating holes, each hole corresponding to a hole to be machined in the workpiece. Location tolerance for the locating holes is ±0.0001 in.

On the front face of the transfer plate are a pocket, or locating blocks, that position the workpiece; workholding clamps; and two T-head bolts that serve as handles when the transfer plate is repositioned or removed from the lathe.

Balancing is critical

When you're machining to tolerances as tight as ±0.0001 in., balancing of the fixture is critical. Where possible, we use a combination of large weights (see large sector-shaped counterbalance in photos) and smaller weights (disk on top of the sector). The large weight, or weights, are bolted and dowelled in place. The smaller weights are added or taken away to maintain balance when the workpiece is relocated on the fixture for machining the various holes. •

For another application of transfer plates in boring, see "Precision Boring with Transfer Plates," AM—Aug 24 '59, p105—Ed.



Operator loads the mechanized feed table for this Modern cutoff machine; from here on all operations are automatic. Paired and opposed cutters cut the stock to length, and a form tool makes radii on both ends. Vertical Merz conveyor at right end raises shaft blanks from cutoff discharge to carry them to transfer machine beyond

From bar stock to finished washer shaft

Transfer line for a L-O-N-G run

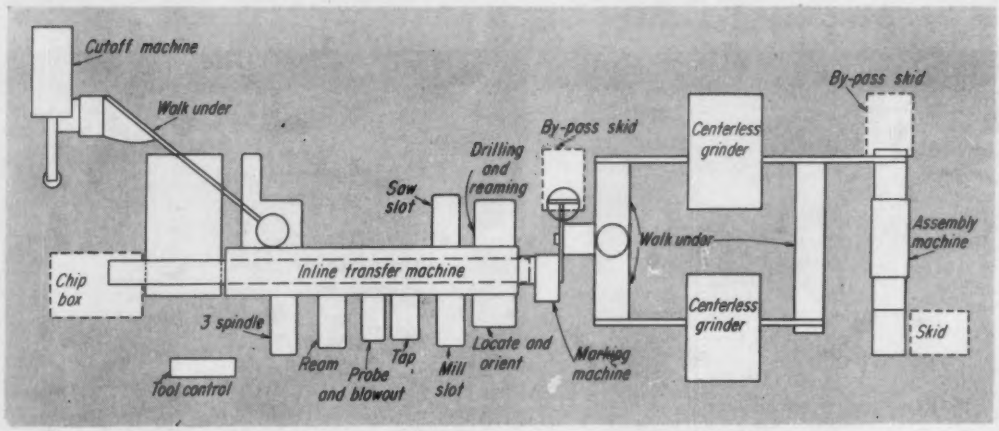
Transfer machine carries two shafts at a time through double stations. First six stations spotdrill, drill half way, and drill to full depth to produce an end hole before reaming and tapping. Toolitrol board maintains regular schedule for tool changing, some at 8000 pieces, some at 14,000 pieces, and some at 18,000 pieces—mainly high-speed-steel tools

By Charles Emerson,
Detroit editor

A small but fully mechanized line has exactly tripled output of automatic washer agitator shafts at Whirlpool Corp, St Joseph, Mich. The new line has upped production of the shafts from 140 to 420 an hour with the same manpower. Accuracy is more consistent, and tool wear has lessened.

The integrated facility takes standard 20-foot bar stock and produces 25-inch washer shafts with holes drilled, an end end hole tapped, the OD ground—and with even a clutch pin assembled through a cross hole.

Whirlpool's production plans for the line were based on turning out over a million parts a year—the idea being that the agitator shaft would not be subject to anything more than minor changes for several years.



Dog-leg layout conforms to space available in machining bay. Production is straight through, except for split at two Cincinnati centerless grinders and right-angle turn at the assembly machine

One such change has already been made, however: An extra drilling station has been installed to produce small-diameter cross holes in service parts. This is operated by gearing-in the extra head and installing cartridge tooling, all of which is easy to remove for a run on current parts.

Actually, the line performs such a high percentage of the total work needed to produce the agitator shaft that only cadmium and nickel plating and chromate treatment have to be done before the shaft is delivered to final assembly.

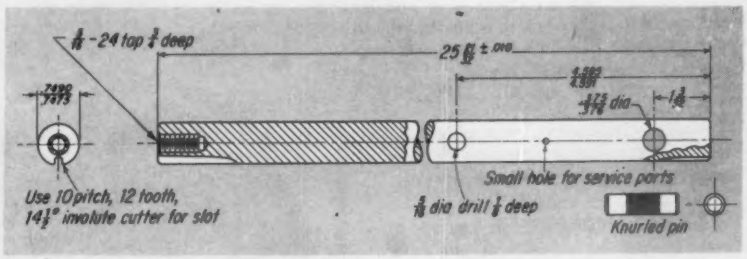
Probably the most interesting machining operation performed by the line is at a dual station (parts go through the transfer machine in pairs, with two machined at the same time at duplicate tooling).

Tapping end holes in steel

Here, Besly Welles X-Press taps form 5/16-24 threads in end holes—an operation not at all normal when the material is steel. Actually, the tap was designed for such nonferrous metals as aluminum and brass, but the washer shaft's C-1213 steel is fairly soft and tapping is aided by lubrication with high-pressure emulsion coolant.

Before being tapped, the end hole is drilled in two steps and reamed to close tolerance. Incidentally, the reamed size had to be adjusted somewhat when the line was first started up (so as to leave just the right amount of stock to be swaged), but now the operation consistently produces a thread with 70% depth.

As to tool life, the new method now averages something like 36,000 parts per tool, compared with 1100 parts per regrind by the old method.



Agitator shaft is of cold-rolled C-1213, cadmium and nickel plated at top end (away from cross pin) for finished appearance and wear resistance. Pin has tapering flats that engage rotating and agitating mechanism in the gearcase. The 5/16-24 thread is cold-formed ¾ in. deep

Pin assembly

Unusual, too, is pin assembly, which follows OD grinding at a separate machine tied to the transfer machine by conveyor and by interlocks that prevent jams if one section of the line malfunctions..

The pin is knurled in the middle to press fit into a shaft cross hole, and has two non-parallel flats that engage the drive mechanism under the washer tub.

Pins are fed down from a magazine. At the same time, a washer shaft is indexed into position, then rotated by a special orienting spindle that brings the hole axis around to a vertical position. At this time the pin is assembled by a hydraulic press into the shaft.

Interlocking circuits

Electric, hydraulic, and pneumatic interlocking circuits are important here because a reject station must operate if the pressure required to drive the pin is too high (meaning the knurled section is oversize), or too light (the knurl is too small), or if no pin is driven (found by a probe station).

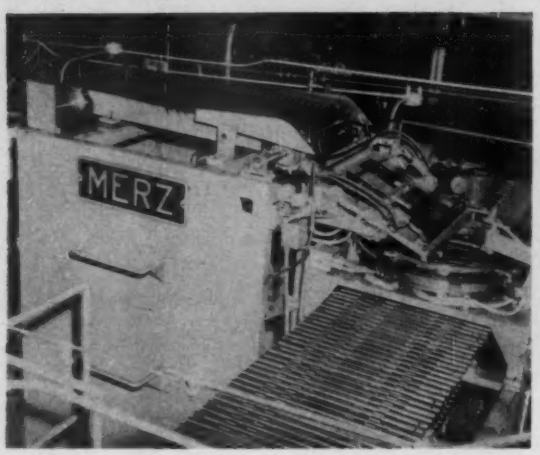
Parts are then transferred to a swaging operation and oriented as in the pin assembly operation. The clutch drive flats are then swaged on both ends of the pin. These flats are held on center within 1½ thousandths of an inch.

No manual handling is required through the line, though the bar stock must be loaded onto the automatic feed table at the cutoff machine and finished parts must be removed by truck from an automatic parts-storage unit just past the assembly machine.

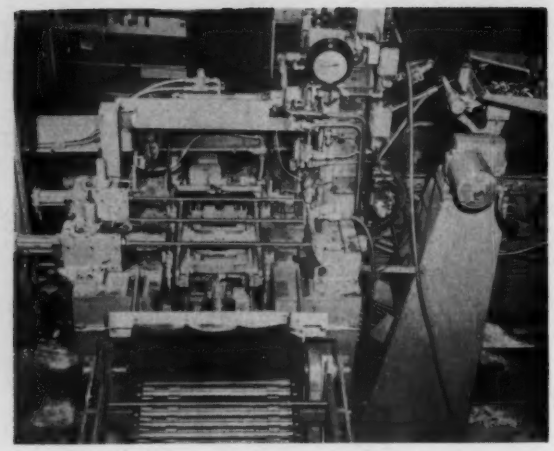
Parts go through the transfer machine via standard transfer bar. Three conveyor sections are fitted with special slats that hold the parts even when motion is vertical.

The conveyor system lifts to leave headroom in two places—just past cutoff and just past the transfer line—to make the off side of the transfer line easily accessible. This allows

Transfer line for L-O-N-G run . . .



Work-holding slats in Merz conveyor space the parts uniformly and will carry them straight up or down without dropout. Carry-up and crossover here is at end of transfer machine. Rotary table accepts parts from straight run of the conveyor and splits the parts flow in two directions to feed two Cincinnati centerless grinders



Assembly machine rotates and orients shafts so hole is vertical, then orients and drives pins. Interlocks in the Merz machine operate an ejection station just past a probe that detects missed pins. Conveyor feeds parts to an automatic storage unit that fills one level with parts, then shifts the conveyor level to fill the next level until whole bank is loaded

for tool adjustment, replacement of the cartridge-type spindles or bearings, and adding of a new station if an additional operation should be required. Sufficient clearance between working stations on the transfer machine is left to allow some added tooling if ever required.

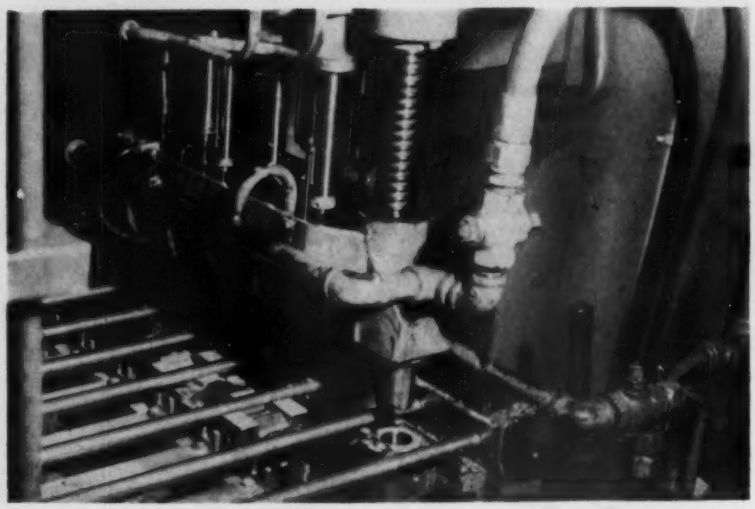
At two points the conveyor includes turntables that change parts-flow direction 90 degrees. One is just past the transfer line, where parts flow is divided evenly to go to the two OD grinders. These machines produce an outside diameter of 0.7490/0.7475 inch.

Automatic cutoff

The Modern cutoff machine operates continuously and automatically on a 5-second cycle, cutting bar lengths to 25 21/32 in. with opposed HSS cutters and tools that radius both ends of each bar.

Parts feed from here to the transfer line, which operates on a 6-second cycle, allowing the cutoff machine catch-up time if it should shut down for any reason. The one operation that requires more than 6 seconds is drilling the end hole before reaming and tapping, and this is split into two operations to maintain the fast line cycle speed.

The first station on the transfer unit has six spindles that spotdrill and drill in two steps. Farther along, a milling cutter produces a slot with an involute-gear shape, and a saw cuts an oil slot in the other end of the shaft at the same time.



Cross-hole station drills two or three holes per part (three for service parts only) as orienting spindles rotate the work to line up the holes in relation to milled slots. Orienting spindles are off to left, at opposite end of work from drills

The final station drills cross holes, one of which takes the clutch pin. To make sure these holes are aligned properly with the already produced saw slot and milled slot, an orienting spindle closes over the end of the workpiece and rotates 360 degrees.

Shaft orientation

During rotation a spring-loaded key drops into the slot in the shaft, and the spindle carries the shaft around to required orientation. A similar arrangement orients the parts in the assembly machine.

Two kinds of special clamps hold parts down on the Crescent Tool & Machine Co transfer unit. A powerful vertical clamp holds each pair of parts at the high-torque tapping operations, which is in addition to the usual work clamp that operates hydraulically with the cutting spindle.

Disappearing clamps hold the work when the two slots are cut. These are pivoted below the transfer table, and swing up and over the work to prevent work shift that might damage the work or could break the cutters. •

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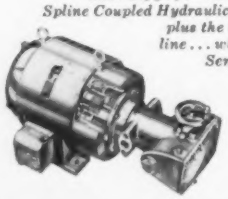

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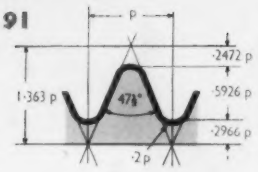
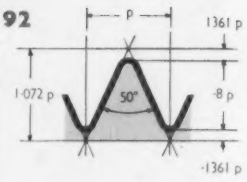
World Screw-Thread Forms—VII

91



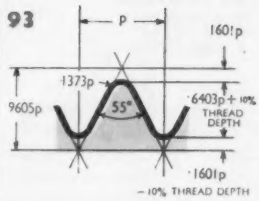
THURY

92



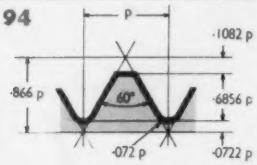
PROGRESS

93



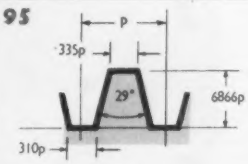
OPTICAL

94



Original S.F. (Systemè Francais)

95



WORM

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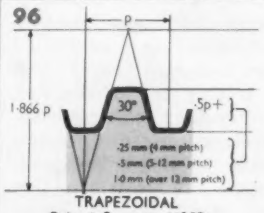
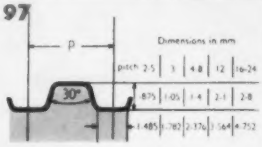


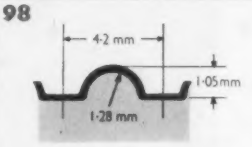
TRAPEZOIDAL
Poland, Rumania, U.S.S.R.

97



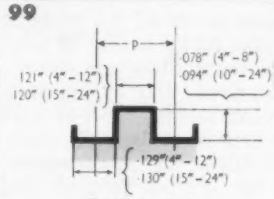
PLASTIC
Denmark, Finland, Norway, Rumania, Sweden

98



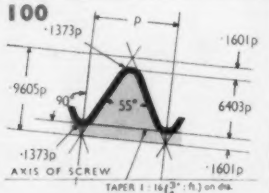
PILFERPROOF
Sweden S.I.S., 71, 10, 49

99



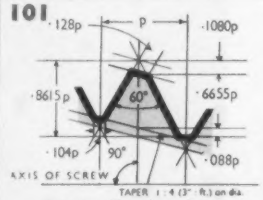
British Standard
SQUARE for Water well Tubes

100



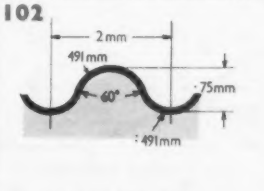
DRILL PIPE
Germany DIN 4917

101



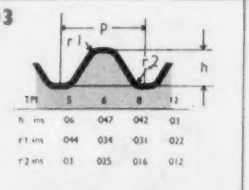
American Petroleum Institute
A.P.I. 8 – Thread

102



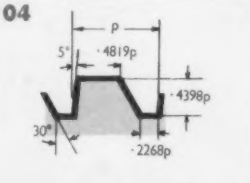
EDISON SPECIAL E21
(See Form 76 for other sizes)

103



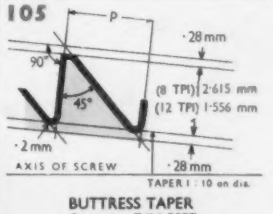
British Standard
BOTTLE CLOSURE

104

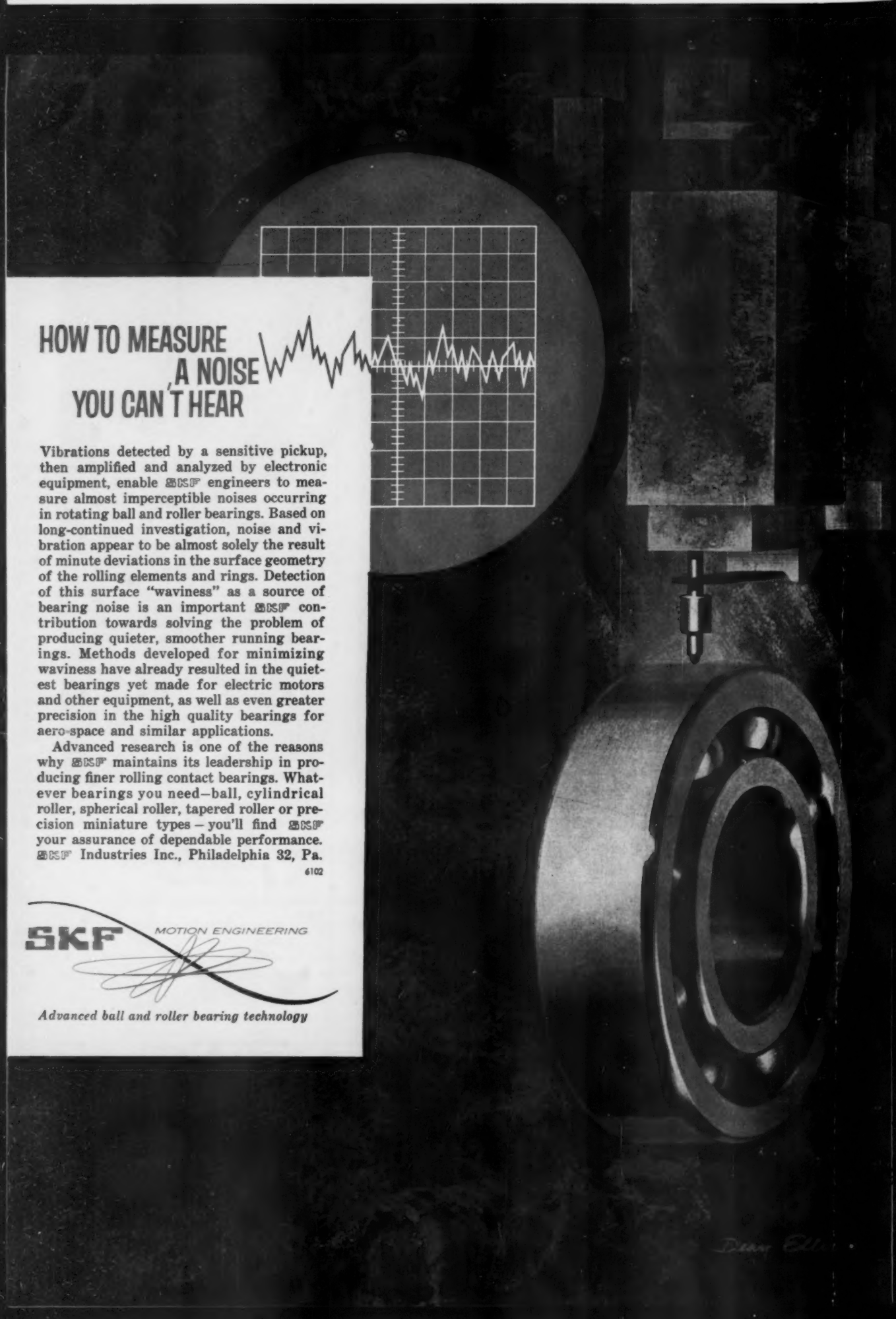


SPECIAL BUTTRESS
(Sweden)

105



BUTTRESS TAPER
Germany DIN 5857



HOW TO MEASURE A NOISE YOU CAN'T HEAR

Vibrations detected by a sensitive pickup, then amplified and analyzed by electronic equipment, enable SKF engineers to measure almost imperceptible noises occurring in rotating ball and roller bearings. Based on long-continued investigation, noise and vibration appear to be almost solely the result of minute deviations in the surface geometry of the rolling elements and rings. Detection of this surface "waviness" as a source of bearing noise is an important SKF contribution towards solving the problem of producing quieter, smoother running bearings. Methods developed for minimizing waviness have already resulted in the quietest bearings yet made for electric motors and other equipment, as well as even greater precision in the high quality bearings for aero-space and similar applications.

Advanced research is one of the reasons why SKF maintains its leadership in producing finer rolling contact bearings. Whatever bearings you need—ball, cylindrical roller, spherical roller, tapered roller or precision miniature types – you'll find SKF your assurance of dependable performance. SKF Industries Inc., Philadelphia 32, Pa.

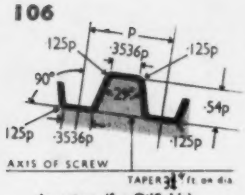
6102

SKF MOTION ENGINEERING

Advanced ball and roller bearing technology

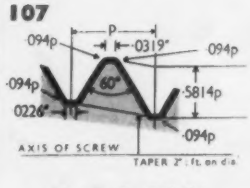
World Screw-Thread Forms—VIII

106



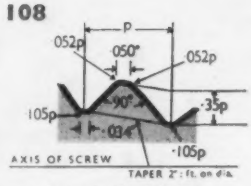
American (for Oilfields)
HUGHES ACME

107



American (for Oilfields)
HUGHES EXTERNAL FLUSH 6TPI

108



American (for Oilfields)
HUGHES H-90

SELF TAPPING SCREWS

Type	TYPE DESIGNATION U S A ASA	Manuf.	Federal	Thread Series	Screw Ends
	THREAD FORMING SCREWS				
A	A	A	A	A	Gimlet point
B	B	B or Z	B	B	Blunt
BP	BP	BP or ZP	BP	as B	Cone
C	C	C	C	ANC, ANF	Blunt tapered
	THREAD CUTTING SCREWS				
D	D	1	CS or 1	ANC, ANF	Blunt tapered with 1 or more cutting edges and chip cavities
F	F	F	CF	ANC, ANF	
F	F	F	CF	ANC, ANF	
G	G	G	CS or Z	ANC, ANF	
T	T	23	CG	ANC, ANF	
BF	BF	FZ	BF	B	Blunt with 1 or more cutting grooves
BG	BG	H	BG	B	
BT	BT	25	BG	B	
	METALLIC DRIVE SCREWS				
U	U	U	U		

NOTES

GERMANY*

DIN 7970, 7971, 7972, 7973, 7974, 7976, 7981, 7982, 7983

A = USA Type A with sizes from A series
B = USA Type A with sizes from B series
BZ = USA Type B with sizes from B series

SWEDEN*

SMS 1519, 1520, 1521, 1522, 1523
K–B = USA Type B with sizes from B series
S–B = USA Type A with sizes from B series

SPAIN*

UNE 17008, 17009, 17010, 17016, 17017, 17018, 17019
A = USA Type A with sizes from B series
B = USA Type B with sizes from B series

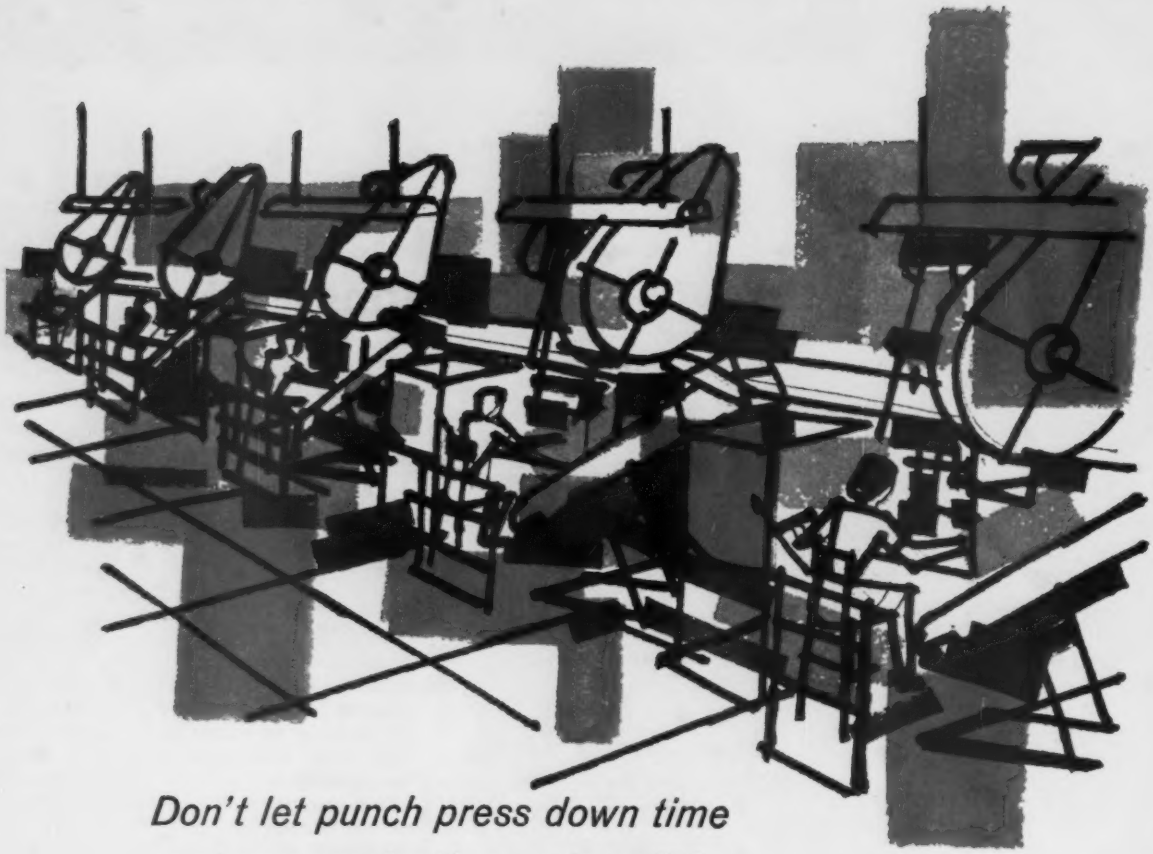
AUSTRIA*

ONORM M5365
A, B, C, D, E (indicates type of head) are similar to USA Type F but threads are Metric from M series

ONORM M5360, 5361 are identical with German DIN 7510, 7511

*Note.
Screw sizes are shown in mm.

Example A4, 9 × 16
4, 9 mm. = .19" = USA size No. 10
16 = length of screw in mm.



Don't let punch press down time cost you production and profit!

Install ALEMITE CENTRALIZED LUBRICATION

Only Alemite has all four Centralized Lubrication Systems... one of them is just right for your punch press or machine needs:

ACCUMITE—small, easily installed system gives positive measured shot of oil or light grease to each bearing.

ACCUMATIC I—simple, single line system for oil or medium weight grease. Wide range of valve capacities.

ACCUMATIC II—twin line system can easily handle every heavy grease that can be pumped.

ALEMITE OIL-MIST—delivers air-borne oil mist to every bearing to lubricate, cool, shut out dirt and grit.

When a punch press has to "knock off" to be lubricated, expensive man and production hours are lost all the way down the assembly line. Not so with an Alemite Centralized Lubrication System! All points that need lubrication get it—*automatically and economically.* Production never stops. Machine life is extended. Breakdowns and excessive wear are minimized. Centralized systems get the most out of lubricant used, keeps it clean since it is applied, through tubing, in measured amounts to prevent waste and product contamination.

For complete details on one or all four systems, write today!

Symbol of SW Excellence

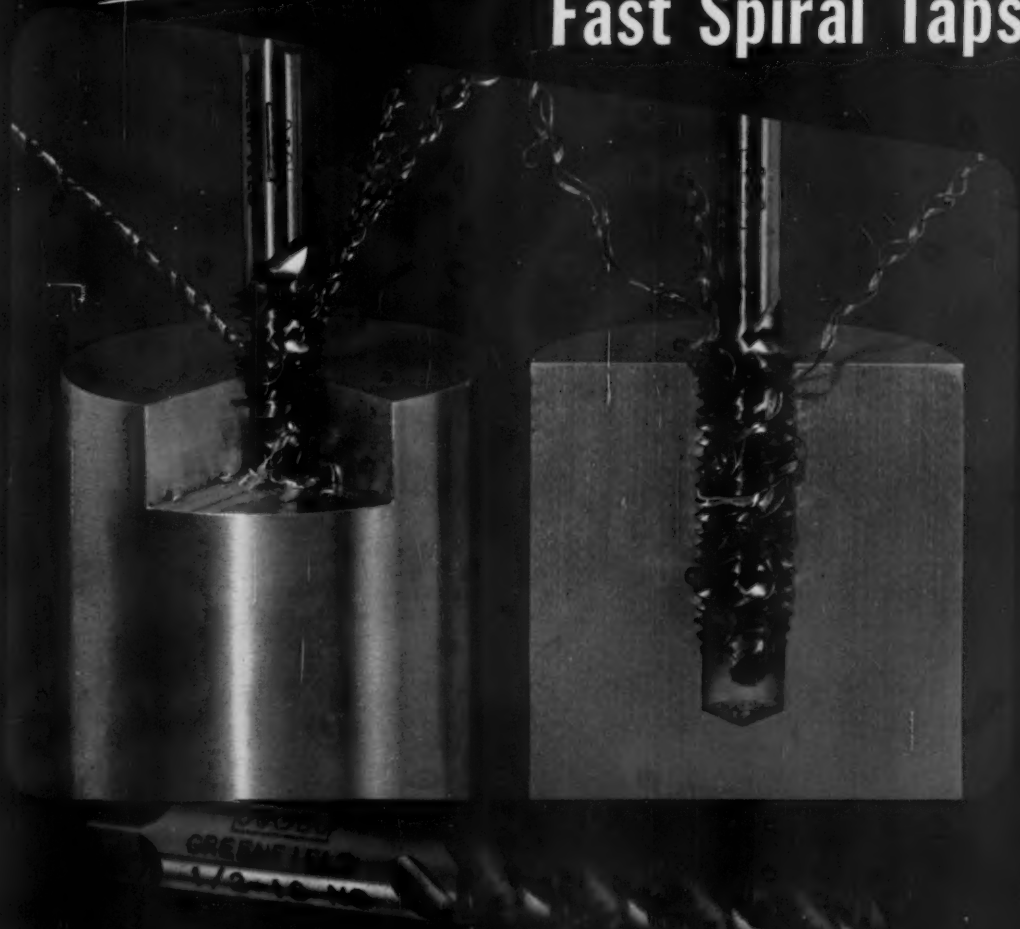
ALEMITE DIVISION
STEWART-WARNER CORPORATION

Dept. C-81, 1850 Diversey Parkway, Chicago 14, Illinois

In Canada: Stewart-Warner Corporation of Canada, Ltd., Belleville, Ontario

LIGHTNING®

Fast Spiral Taps



Spiral fluted taps have long been noted for their efficiency in ejecting chips from blind holes by virtue of their "lifting" action which reduces friction and minimizes the tendency of chips to clog in the flutes. They are especially recommended for use in ductile and other free cutting material.

LIGHTNING® taps, which is the GREENFIELD version of the ***"fast spiral"*** development in tap flutes, emphasizes this lifting action to a marked degree. Its ability to span slots or other interruptions and to tap relatively deep holes in a wide variety of materials has resulted in a lightning spread of popularity among tap users. When you buy ***fast spiral taps,*** specify LIGHTNING®

INDUSTRIAL DISTRIBUTOR
SERVING INDUSTRY ECONOMICALLY
THE RIGHT HAND OF PRODUCTION

GREENFIELD TAP & DIE GREENFIELD, MASS.

New Safety-Lock Tab • Improved Cup Shape Add Increased Protection and Comfort to AO Flexible Mask Goggles

Here are four improvements that make these new AO Vinylite Mask Goggles safer to use, more comfortable to wear:

1 New lock tab, with snap button, holds lens securely to frame at point of greatest stress, improves fit around entire frame. Lens will not pop out, but can be removed quickly and easily for cleaning or replacement.

2 New recessed slots at end of cup fit *over and around* temples of safety (or regular) glasses to keep entire cup edges in contact with face.

3 Increased eye cup depth gives additional coverage and protection at temples.

4 Improved flash around entire edge of mask molds to contours of face.

Lightweight, well-ventilated, extra-large face mask and .050" thick acetate lens assure the wearer of comfortable, optically correct, wide-angle vision while protecting entire eye area.

Your nearest AO Safety Products Representative now has this improved new model in impact goggles, chemical goggles, welding goggles, or chipping and grinding goggles, as well as two special models for maximum protection against chemical splash. Contact him today, or write for detailed folder, S-1229.

Your Surest Protection . . . AO SURE-GUARD GOGGLES

American Optical
COMPANY

SAFETY PRODUCTS DIVISION • SOUTHBRIDGE, MASSACHUSETTS

Talking Shop

Selling Method

SOME YEARS AGO a pair of authors kept checking when we were going to publish an article they had written and we had accepted. Pressed to explain why the rush, one said: "This will save so much we're anxious to have the rest of our divisions see it, but if we send out a memo they won't read it. If you publish the story they'll read it and be after us for more dope. Most of them will start using it right away."

We are reminded of this by an unusual memo that we'll bet people read. While it may not be smart of us to promote the reading of memos instead of finding out what your company is doing by reading AM/MM, there is a place for both.

The memo in question is put out by Tool Development Div at North American Aviation in Columbus. Glenn W Periman is responsible for the memo which is illustrated by cartoons drawn by one of his staff and gives a fast summary of projects. When you want more details, you go ask for them.

Our kudos to Periman and his staff —and to North American Aviation for not insisting that a project report look like a project report and read like the fifth volume of Gibbon.

Research Center

PLANS FOR a research and standardization center are being drawn up by Italy's association of machine tool builders. It is expected that the center will take at least two years to get into operation. About half the operating cost will come from Italy's National Research Council, about 7% will come from the machine builder's association. The rest is to come from individual builders and from firms that use the research center.

Conical Shocktube

A FIVE-POUND charge of explosive produces a blast wave as powerful as those generated by firing (all at once) six of the biggest blockbusters ever used in World War II. The secret is a shock tube built into an old gun. The shock tube is a cone 5 in. in diameter at the base, 30 in. at the mouth, and 180 feet long. It reproduces a tiny segment of the shockwave from a normal spherical blast in the open.

The tube, installed at the Naval Ordnance Laboratory in Silver Spring, Md, is really a scale model of a 2000-ft shock tube that will simulate the blastwave from a nuclear explosion. Such tubes provide an economical way to test the shock resistance of materials by placing them at various points in the tube.

Sleeper

WHEN the American Society for Quality Control held its annual meet-in Philadelphia recently the program was loaded with papers on missile reliability. Sandwiched in among them was "Quality Control Techniques in Casino Operations" presented by Charles Hirsch from The Golden Nuggett in Las Vegas.

What puzzles us is what does a gambling casino control quality of?

Watch That Lawn Mower

NOW THAT THE LAWN mowing season is in full swing, Republic Steel Corp passes along these suggestions for the safe use of power mowers:

Most accidents are caused by carelessness—usually while starting the machine, or as a result of lawn litter being whirled out by the blades. Remove from the lawn all objects that might be hit by the whirling blades. Cut sideways on hills and terraces—if you slip while cutting up, the mower might roll back over you. Don't rotate the blades by hand unless the sparkplug is first disconnected—otherwise you may crank the engine to a start. Don't add fuel if the motor is hot and has not been shut off for several minutes.

Slot Size

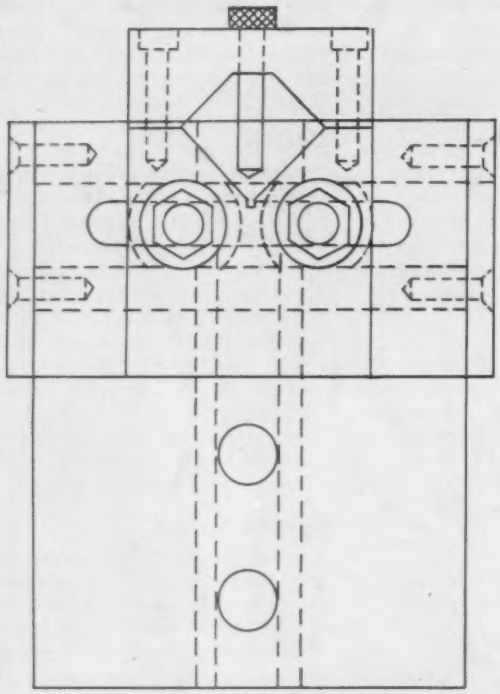
THE TAPERED SLOTS being cut by the EDM process (*AM/MM*—Mar 20 '61, p142) at Argonne National Laboratory taper from 0.045 to 0.015 in. Those wandering decimal places that plague us all from time to time wandered into the manuscript and made the slots larger. They still looked pretty small and the error was missed. Everybody concerned is very sorry, but the details of how the slots were cut were accurate. Argonne is just doing an even trickier job than we credited it with.

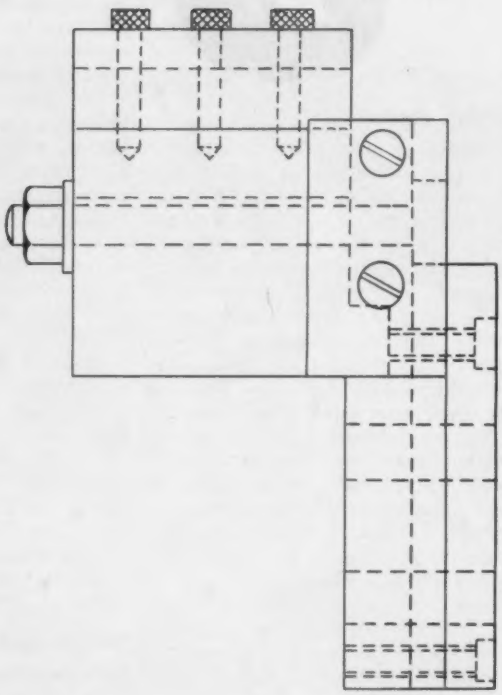
Chrome Galore

THE PART THAT CHROME PLATING plays in today's automobile is exemplified by the installation at Pontiac. It uses enough electric power to serve a city of 36,000 people and has in constant service a quarter-million pounds each of copper and nickel electrodes, 72,500 gal of copper plating solution, 171,000 gal of nickel solutions, and 21,000 gal of chrome solutions. Noxious wastes are chemically treated and made harmless at the rate of 1500 gal per minute. The installation is spread over the main assembly plant at Pontiac, six B-O-P plants, and dealer service setups. •

Practical Ideas

Fixture Simplifies Eccentric Grinding





This fixture consists of two major parts: a baseplate and a V-block. The baseplate has a tenon fitting in a slot in the rear face and attached by two screws. The width of the tenon is made to suit the slot in the grinder faceplate on which the fixture will be mounted. The V-block carries a tongue along its lower back face which is a sliding fit in a groove across the front of the baseplate. A groove across the back of the faceplate accommodates the round, flatted heads of two bolts which pass through an elongated slot in the base plate and through holes in the V-block to lock the latter in place.

A hardened and ground setting plate is attached to each side of the baseplate by two screws, and projects about ⅜ in. beyond the face. The V-block is hardened and ground in the V, on both sides, and on the top and bottom of the tongue. A cap is attached to the top of the block and carries three clamping screws.

To grind an eccentric pin, place the straight shank in the V-block and tighten the clamp screws. Loosen the V-block locking bolts slightly and adjust the block until the shank indicates perfectly true. Tighten the locking bolts, and measure the distance between one side of the V-block and the corresponding setting plate by means of gage blocks.

Subtract from this measurement the amount of eccentricity desired, and build up gage blocks to correspond. Release the locking bolts and move the V-block until the gage-block stack will just fit between it and the setting plate. Tighten the locking bolts.

For an eccentric bushing, the work should be mounted on a taper mandrel. The tapered portion should be only slightly longer than the body of the bushing, and there should be a sufficient length of straight shank to hold in the V-block.

H Singh, Calcutta, India

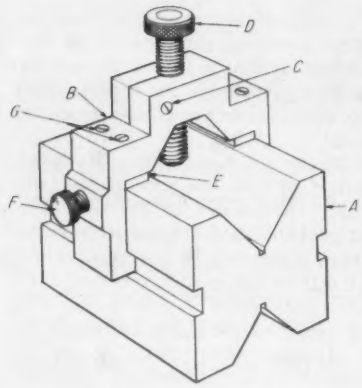
It's Easy to Solder Aluminum

A simple but effective way to solder aluminum is to chuck a medium-grit grinding wheel in a small hand grinder and heat the wheel with a low torch flame, or even a cigarette lighter. With the wheel warm and rotating, hold it against a bar of 40-60 tin-lead solder until it is charged with solder particles.

Then grind the surface of the aluminum, and the heat produced will melt the solder and tin the freshly abraded surface. Conventional soldering methods can then be used to complete the job and produce a satisfactory bond.

H Muller, Dansboro, Pa

Attachment Simplifies Cross-Drilling



This cross-drilling attachment ensures accurate centering of the drill on all sizes of round stock within its capacity. It consists of a yoke B which engages the side slots in a standard V-block A, and can be made of CRS, brass, or aluminum. The top section is slit so the setscrew C can be used to take out the slack and maintain the accuracy of the screw bushing D, made of hardened tool steel. Knurled screws F clamp the yoke securely to the sides of the V-block. Gibs E and screws G are provided for adjusting the yoke to the block on which it is to be used.

The hole in the screw bushing is made to suit a combination center drill for spotting the hole center. After spotting, the combination center drill is removed and the hole drilled through with a regular drill of the desired size. Drill bushings are not ordinarily required, although they may be inserted in the screw bushing bore if very small drills are needed and there is danger of breakage. The screw bushing serves to clamp the work in the V-block, as well as acting as a guide for the center drill.

Frederick C Lurz, Garden City, NY

Plastic Wheel Guard Improves Work Visibility

On many grinding jobs with a toolpost grinder, or with a tool and cutter grinder, the operator is tempted to remove the guard to improve work visibility. This creates a very serious hazard so, to eliminate it, we made up a clear plastic guard. This is not intended as a permanent substitute for the regular metal guard and is used only when maximum visibility is absolutely essential.

The support bracket was bandsawed from a piece of heavy steel plate and is mounted on the grinder quill. The guard was made from heavy transparent plastic which was heated and bent to fit the bracket.

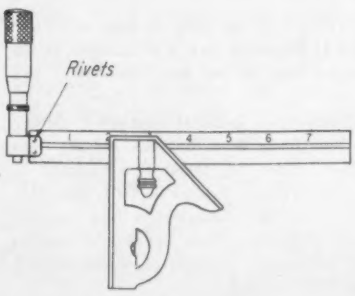
While using this guard we have had one wheel break. The plastic was cracked, but it stopped the wheel fragments effectively.

H J Gerber, Stillwater, Okla

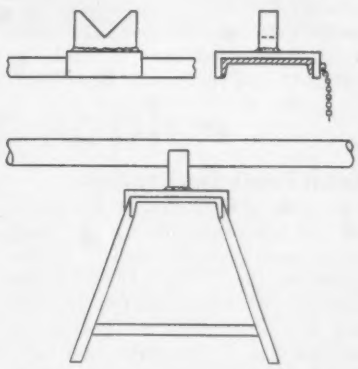
Attachment Checks Squareness

It is an easy matter to check the squareness of a piece of barstock with an ordinary combination square, but we needed to know how much it was out of square and how much fading there was at the corners. To find this, we attached a micrometer head to the end of the blade of a combination square by means of a clip and rivets, adjusting it so the micrometer read zero when the end of the spindle was exactly flush with the lower edge of the blade. This permits us to obtain exact readings in thousandths and does away with the need for an assortment of feeler gages.

Wilbur T Schrum, Jr, Latrobe, Pa



V-Block Holds Shafts Safely



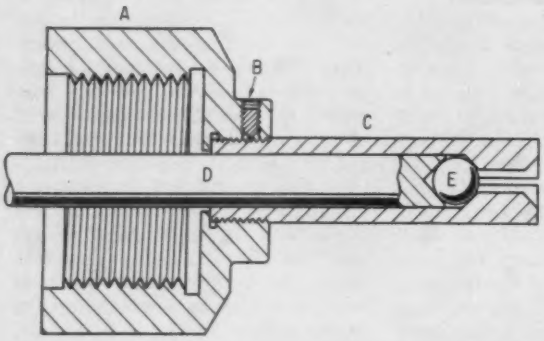
We handle a lot of shafting jobs in our shop, doing such jobs as fitting gears, pulleys, and keys, and support the work on a pair of standard steel horses. But it was always a nuisance to have to scout around for wooden wedges to block up the shafts, and there was always an element of danger if the wedges should slip.

To get around this I made up two U-shaped members to be a free sliding fit on the cross-piece of the horses, and to the top of these I welded heavy V-blocks, as shown. Because we use the horses for other jobs, I could not weld the brackets in place so, to prevent them from getting lost, I welded a length of chain to the bracket and the opposite end to one leg of the horse.

L J Diot, Torrance, Calif

Practical Ideas

Expanding Mandrel Made from Collet



Feed fingers or collets, as used on many automatics, offer a ready means of making expansion mandrels for holding tubular work in a turret lathe equipped with a pusher-tube type of collet mechanism.

The adapter *A* is made of machine steel and tapped to the fit the spindle nose of the machine. Its front end is tapped to suit the feed finger or collet, and has an internal shoulder against which the collet can bear. A setscrew *B* locks the collet in place. Note that most collets have a left-hand thread.

Part *C* is a readymade, hardened and ground, feed finger whose OD is slightly greater than the ID of the work to be held. After screwing the feed finger into the adapter, the setscrew should be turned in just far enough to make a small impression in the thread. Then the finger should be removed and a dimple made to prevent thread damage.

The operating rod *D* is turned down at its right-hand end so it will slide freely inside the bore of the feed finger. A ccuntersink is machined in the end. The length of this rod will depend upon the lathe on which it is used, and it should preferably have a head at the left-hand end to fit freely in the spindle bore and butt up against the pusher tube.

A hard steel ball *E* is placed inside the feed finger so that, when pressure is applied to the rod *D*, it will be forced into the chamfer in the feed finger and cause the latter to expand.

After making the setup, operate the collet mechanism to expand the feed finger until it is parallel along its outside diameter. Then grind the OD with a toolpost grinder to suit the work to be held.

The particu'ar advantage of mandrels made in this way is that they are easily replaced from stock, and are already hardened and tempered, and of the correct spring steel.

Stanley F Parkes, Smethwick, England

Hatch Feeds Stock to Saw

By cutting a hole through the brick wall of our stockroom we can feed tubing and barstock directly to the power hacksaw. The bottom of the hole is faced with a steel wear plate and is aligned with the bottom of the saw vise. It also serves as a support for long pieces. In this way we avoid the difficulty of manueuvering the material through the doorway, and then returning the unused part.

Why don't we put the hacksaw inside the stockroom? That's easy; there isn't room.

H J Gerber, Stillwater, Okla

BLANKING DIE SHAVES EDGES IN SINGLE OPERATION
Was the winning entry in the May 29, 1961 issue.

The $25 prize is awarded to:
AG, Budapest, Hungary

AN EXTRA $25 will be paid for the best Practical Idea in each issue of American Machinist/Metalworking Manufacturing. All items appearing on the Practical Ideas pages are eligible. In case of a tie, duplicate prizes will be awarded.

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Charles H. Smith, Jr.

took over Cleveland's Steel Improvement & Forge at the tender age of 21, walking, as he puts it, into "a hornet's nest of labor problems." So well did he solve them that today he is an international authority on labor relations. Proof that he has an uncanny knack for . . .

Getting along with people

"I came up the hard way, succeeded my father as president." Charlie Smith's sense of humor has been no small asset in converting what he calls "a hornet's nest of labor problems" into one of America's top employee relations programs.

President at 21

Now 40 years old, Smith has been president of Cleveland's Steel Improvement and Forge Co. since he was 21 and fresh out of MIT. At that time, the firm, a privately held commercial forge shop shipping most of its output to the aviation industry, was enjoying the boom and the headaches of the war years.

SIFCO's pre-World War II sales had hit the million-dollar mark only once, but the wartime peak went to $15 million. Then with peace came a drastic drop in sales—down to $3 million in 1946 and 1947—and labor troubles. Smith went to work on the twin problems of getting sales back up, and of un-straining SIFCO's very-strained employee relations. Characteristically, he attacked the latter problem first. Two serious strikes made fast action on these problems imperative.

"During the war," Smith relates, "the national pressure upon output for victory outrode everything else. Wages were controlled by government. There wasn't time to process grievances or bother with complaints. There was no escape valve for discontents. Then suddenly the war was over—the lid was off. All the pent-up emotions of the men boiled over. Now, they thought, 'we can get what we've been waiting for.'

"But there was no way to give it to them. We had no business—cancellations were coming in by the hundreds every day.

"There were bickerings, there were slowdowns, and then the situation came to a head in two 8-10 week strikes, one in 1945 and one in 1946. There were the usual picket lines, there was violence, and on the whole things were pretty rugged. The picture was complicated because we had a variety of craft unions to deal with.

"My father, who built the company from the ground up, never accepted the idea that professional union people could really have the best interests of our employees in their hearts. He therefore resented the necessity of dealing with them, and this point of view had naturally been reflected in company policy.

"I decided that unions were here to stay and that we must learn how to work with them. I believed that most of the men in the shop were pretty level-headed people. I thought they would view things reasonably if they knew the facts about what the company was trying to do, what our difficulties were, and so forth.

Getting shop cooperation

"I figured that if you tell the shop people nothing, if you say company affairs are none of their business, you can't expect cooperation; but that if you lay problems before the men in the shop, problems that

affect everybody in the company, and explain how management is trying to solve them, the shop people will work with you. Anyhow, I went forward on that premise and I've been at it ever since."

Following the second strike, Smith started a program of talking to the shop people in a group, with simple slides to explain company problems. Then, he inaugurated a newsletter to employees (which he still writes himself). Next, SIFCO held open house so that employees could bring their families into the plant to see the kind of work they did, and meet other SIFCO people.

Next came supervision. "Our foremen were competent technically," says Smith, "but they couldn't do a good enough job explaining things to their men, because they themselves weren't sufficiently familiar with the facts." So SIFCO started a program of supervisory education—a series of monthly meetings, with each meeitng devoted to the function, problems and goals of a particular department.

Good community relations

Also important was the neighborhood attitude toward the company. A forging plant inevitably causes noise and vibration. People were heard to say, "I wish we didn't have that plant in this neighborhood." This called for the establishment of a community relations program, which meant getting personally acquainted with leaders in the community and stressing the neighborhood's dependence upon SIFCO's payrolls. A parish priest, for example, changed his attitude after he made a visit to the plant and saw how many of his own parishioners were working there.

"I would say, said Smith, "that labor relations consist primarily of giving all people concerned the pertinent facts. If you don't tell them yourself, they'll believe what the other fellow tells them. Above all, it's important to convince the men in the shop that both management and workers belong on the same team. Today we have excellent cooperation in the shop and very little 'labor trouble,' but one has to be everlastingly working at it."

Smith's early and imperative interest in labor relations led him to dig deeply into the subject. "I was fresh out of college," he explains. "I had no boss to tell me what to do and I had to learn things for myself." So he was glad to accept an invitation to be a member of the Industrial Relations Committee of the National Association of Manufacturers; also becoming, not long thereafter, a member of the Labor Relations Committee of the US Chamber of Commerce. Out of these associations arose Smith's nomination in 1953 as an Employer Advisor to the ILO (International Labor Organization) Conference of the United Nations. In 1956, he was appointed Employer Delegate for the United States at the ILO's Annual Geneva Conference, and more recently represented the US at an ILO Inter-American Conference in Buenos Aires.

The sales buildup

With all his attention to employee relations, however, Smith didn't lose sight of his other goal—building up sales. In 1956, SIFCO's peak year, sales hit $30 million, and even today they stand well above World War II's peak $15 million.

In the Cleveland area alone, SIFCO has expanded physically to six or seven times what it was when 21-year-old Charles Smith, Jr, took over as president of the company. He was named, by the way, one of the country's 10 "outstanding young men" in 1955 by the US Junior Chamber of Commerce.

In the last five years, SIFCO has been busy acquiring subsidiaries and establishing overseas interests such as that in Industrias Kaiser Argentina. There, SIFCO supplies technical assistance and operates a forge shop it helped build at Cordoba. The company also has a one-third interest in SIFCO do Brazil.

Smith makes frequent trips to South America. This is essential, he says, in order to understand their methods of doing business, and laws and regulations. Labor relations present problems to which we in the States are, to say the least, unaccustomed. For example, in Brazil government regulations prescribe what is in effect a guaranteed annual wage. Men must be paid whether they work or not. So you don't fire people, or lay them off. You can't afford to. In Brazil labor is a fixed cost.

"Down there," says Smith, "the unions don't put bargaining pressure on the employers. Instead, they put pressure on the government to pass laws compelling employers to do what they want."

In 1957, the company acquired Custom Tool & Manufacturing of Minneapolis, and in 1959 formed SIFCO Metachemical to operate in the electrochemical field. This subsidiary has the North American rights to processes developed by France's Labratoire Dalic and England's Metachemical Processes, Ltd.—an organization in which Steel Improvement has an interest.

"We feel electrochemical machining has the greatest potential of anything we're doing now," Smith says. "We expect our electrochemical activities in 10 years to be as large as our forging business is now."

"We got interested in electrochemistry as a cheaper method of forming the dies used in our forge shop," Smith says. "Now we feel that there are many areas in which it will machine parts from forgings more economically than will conventional methods."

Started in the shop at 15

Charlie Smith's success with workers may be credited to the fact that he is one of them. True, he is the "young man who started at the bottom of the ladder but his father owns the ladder," but there the resemblance to the traditional boss's son ends.

He began working in the shop when he was 15, starting at about as low a rung as possible—as a cold inspector. Since then, he's done just about everything around the plant and consequently knows just about everyone by his first name.

Today, at 40, he is a metalworking management veteran who has fulfilled the promises he made to himself in his salad days as SIFCO president. He has brought the company up to new production peaks, and he has smoothed out what was originally a rough labor situation so well that some of the men who once were damning the management for failure to meet union demands are now inside management of the company, helping the company increase productivity.

"The quality of sincere leadership is rare and valuable," says Smith. "A man who pleads well for a reasonable union cause, and is listened to by the men, can plead equally well for a management cause, once he understands the facts. That's where we have gotten some of our best foremen."

The forging business, says Smith, is one of the most competitive in the world. Shifting markets, new developments, and new allied products and processes demand perpetual attention. The going, he says, is always tough. Productivity is the key to survival—and the key to productivity is sound labor relations. •

Names in the News

Lapointe Machine Tool Co, Hudson, Mass, has named **Joseph P Crosby** (left) vice president, director of sales, and **James W Dopp** vice president, sales. **Mike Fox** succeeds Mr Dopp as sales manager of Lapointe Machine Co, a wholly owned subsidiary. Mr Crosby will direct sales policies of both companies

Mitts & Merrill Inc, Saginaw, Mich, machine tool manufacturer, has appointed **Gordon V Anderson** general manager. **Jack Ranous,** chief engineer, succeeds Mr Anderson as sales manager

Mack Trucks Inc, Plainfield, NJ, has named **Nicholas Dykstra** president and chief executive officer. Mr Dykstra was most recently vice president of finance and director of McDonnell Aircraft Corp, St Louis.

Allis-Chalmers Manufacturing Co has appointed **Leonard J Linde** director of engineering, Industries Group. He has been serving as director of engineering services for the past year.

Capewell Manufacturing Co, Hartford, Conn, has elected **Philip C Sayres** president. **Staunton Williams** has been named board chairman and chief executive officer. Mr Sayres was administrative vice president of Richardson-Merrell Inc, formerly Vick Chemical.

Judson L Thomson Mfg Co, Waltham, Mass, has appointed **Douglas Downes** vice president, engineering. He has been associated with Thomson since last December as technical director and, prior to that, was connected with De Havaland Co, England, where he was responsible for control-system developments for jet aircraft.

Leeds & Northrup Co, Philadelphia, has promoted **Elwood F Rogge** from manager of the North Wales plant to director of manufacturing for the company.

Borg-Warner Corp has appointed **Robert V Merrell** vice president, sales, of the Atkins Saw Division, Greenville, Miss. He was formerly general sales manager.

Vickers Inc, Detroit, has **appointed Roy Golze** to the newly created position of midwestern regional manager in the Industrial Sales Department, Machinery Hydraulics Division. He formerly managed the Philadelphia district office. **M R Fox** has been named customer services manager and **R J Render** product planning manager.

L & J Press Corp, Elkhart, Ind, has named **Earl R Dew** sales manager. Mr Dew has served with press manufacturers in sales and engineering capacities for the past 20 years.

Mechanical Air Controls, Detroit, has named **J B Komendera** sales manager. He was formerly associated with Valvair Corp.

(Continued on p 183)

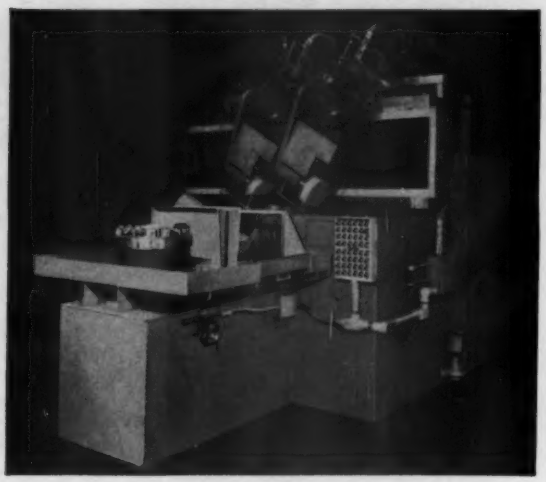
E W Bliss Co, Canton, Ohio, has elected **Carl E Anderson** president and chief executive officer. Board Chairman **Robert Potter** has been serving as acting president. Mr Anderson was previously director of general management consultation for Ebasco Services Inc

Elox Corp of Michigan has named **C Paul Porterfield** director of sales. He was formerly vice president of Method X Division of Firth Sterling Inc of Pittsburgh. Method X was recently purchased by Elox to broaden its sales of electrical discharge machining units

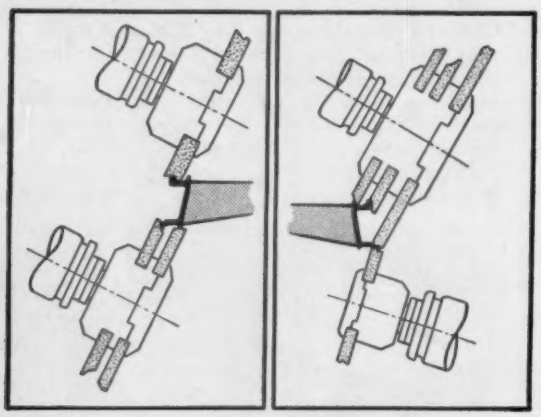
Harron, Rickard & McCone Co of Southern California, nationally known distributor of machine tools, has named **Harold F Robinson** to the newly created post of numerical control engineer. He was formerly facilities engineer with Douglas Aircraft's Long Beach Division

Vertical grinding 19 surfaces efficiently

Turbine blades for jet engines require such precise accuracy and smooth finish on so many surfaces that the only economical way to grind them in large quantities is *vertically*. In vertical grinding, whether on standard machines or complex specials, gravity works directly for you. The machine does not have to overcome gravity—the result is simplified fixturing and efficient, highly accurate indexing. Single or multiple grinding heads advance to difficult surfaces, grind, then retract for automatic dressing and size control as a new piece is indexed.



Vertical production grinder shown above is typical of Springfield four-head machines in jet engine plants. An upper and lower head are located at each station. Station operations are shown below.



Left station — 7 surfaces ground in one pass.

Right station — 12 surfaces ground in one pass.

When high production and accuracy dictate your grinding requirements, it will pay you to investigate the Springfield principle of vertical grinding. The pay-off is also in floor space savings and in the fact that heads usually can be repositioned when part requirements change.

If you would like to know more about the vertical grinding principle, please send for our Bulletin 197-C. The Springfield Machine Tool Company, Springfield, O.

SPRINGFIELD

Polymer Process Cuts Cost of Large Nylon Castings Below That of Stainless, Brass

Nylon has entered an entirely new phase, according to The Polymer Corp of Reading, Pa, because of a new process called monomer casting. No longer a premium-price material, it can now compete with the medium- and low-price resins—and even with metals. MC nylon is already substantially lower in cost than identical castings in stainless steel, brass, and bronze, and additional price cuts are predicted.

The present raw material price for MC nylon is just half the price for conventional nylon polymer, ready for molding. Major reason is that the lengthy process of polymerization has been completely eliminated. Monomer casting is a direct conversion of nylon from basic chemical raw materials to finished parts and shapes.

Another big gain is that MC nylon is cast at atmospheric pressure. Therefore, mold costs are about 1/5 or 1/10 what they are for comparable parts made of other types of nylon. And there's no limitation on part size.

The new material—MC nylon 901—is comparable to Type-6 nylon in chemical resistance and electrical properties, but many of its mechanical and thermal characteristics are distinctive. Outstanding are its resistance to creep and to fatigue under stress, and its ability to retain rigidity at elevated temperatures.

Initially, the material has been applied where nylon's characteristics are already known and accepted. However, field tests indicate many new areas where it will compete with other plastics and with metals. One of the important ones is equipment for handling abrasive materials. Examples: liners for foundry cores and components of cement-block-making machines. Cams on automatic screw machines are said to be another good application.

There's also a potential in roll covers—MC nylon can be cast right on a steel mandrel. Examples here are mostly in the paper industry (wallpaper printing rolls back-up rolls for cutting lace paper doilies), but tests are also underway in the steel industry (idler rolls, drive rolls, and hold-down rolls).

At present, Polymer is supplying the following mill shapes: tubular bar with ODs from 2 to 15 in. and IDs from 1 to 14¼ in.; plate, 24x48 in., in thicknesses from ¼ to 4 in.; and rod in diameters from 3 to 8 in. and lengths from 6 to 24 in. Limited production capacity is also available for complex shapes ranging from 1 to 100 lb.

The Polymer Corp, 2120 Fairmont Ave, Reading, Pa

MORE DATA? Circle 91, inside back cover

Plastic Coating Protects Metal Product Finish During Forming

Savings on formed metal end polishing costs of up to 100% have been achieved with Washguard protective plastic coatings, according to the manufacturer. The coatings can be applied for as low as ⅛ of a cent per square foot of surface and will protect metal during roll form, deep drawing, and bending.

Washguard, which is a dispersion of plastic in water, is available in two types; W-8614 which gives a red coating, and W-5460 which leaves a clear coating. Both types are removed with water and can be spray or roller-applied to surfaces.

Applied at a dry film thickness of 0.5 mils, the coatings air dry at room temperature in 30 min and can be force dried in 1 to 2 min at 200 F. One gallon covers 500 to 700 sq ft at 0.5-mil thickness.

Guard Coatings Corp, 8-05 43 Ave, Long Island City 1, NY

MORE DATA? Circle 92, inside back cover

Lubricant Coating Also Gives Protection Against Corrosion

Electrolube is a new air-drying solid film lubricant that can be applied by spraying, dipping, or spray-tumble. The coating combines corrosion resistance and lubrication in one step, eliminating the need for other coatings such as paint or electroplate. Parts coated with Electrolube have withstood 100-hour salt-spray tests with no visible traces of corrosion, according to the manufacturer.

In production tests, 339 lbs of aluminum die-casting coated at a rate of 45 pieces per hour used only one gallon of Electrolube concentrate. The coating is 0.0002 to 0.0005-in. thick and has a coefficient of friction of 0.025 under high loads.

The concentrate is available in 50 gallon drums or 5 gallon cans.

Electrofilm, Inc, 7116 Laurel Canyon Blvd, North Hollywood, Calif

MORE DATA? Circle 93, inside back cover

Sticks Measure High Temps

Tempilstiks will measure temperatures in the range from 2000 to 2500 F in intervals of 50 deg instead of the usual 100:deg increments. The new sticks give metallurgists a convenient means of determining high temperatures with an accuracy of 1%.

Tempil Corp, 132 West 22 St, New York 11, NY

MORE DATA? Circle 94, inside back cover

Electrode Stock Resists Erosion In Electrical Discharge Machining

Designated Speer Kostkutter graphite stock, this new material is capable of removing large volumes of metal in electrical discharge machining while remaining relatively uneroded itself. Readily machinable, the stock can be easily fabricated into any desired shape. Its resistance to edge breakdown helps assure good cavity detail.

Physical properties of the graphite stock are as follows: apparent density, 1.65 gm per cubic centimeter; breaking strength parallel to forming pressure, 4000 psi; specific resistance, 0.00045; and hardness, (Scleroscope) 35.

Speer Carbon Co, St Marys, Pa

MORE DATA? Circle 95, inside back cover

EDLUND MODEL NPB

PRINTED CIRCUIT BOARD DRILLING MACHINE

DRILL PRINTED CIRCUIT BOARDS FASTER, CHEAPER, AND MORE ACCURATELY

Now High Speed, Versatile, Tape Controlled Machine drills Printed Circuit Boards with amazing accuracy in a wide variety of material at low cost.

This High Production drilling machine is actually 16 drills in 1, it drills four boards or stacks of boards simultaneously, operating at 50 cycles per minute under average conditions. **Time Saving Versatility** is featured with 4 independent air feed units in each drilling cluster, each unit capable of carrying a different drill size and operating at spindle speeds up to 22,000 RPM. **The Tape Controlled point positioning** table and drill units assure maximum accuracy and reliability. Now drilling speed and size changes are done automatically, eliminating time consuming manual tooling and set-up.

Printed Circuit Boards Drilled on Edlund Machine

Edlund Model TPR Programmer for Tape

EDLUND PROGRAMMER PREPARES TAPE DIRECTLY FROM ART WORK

This unique Programmer prepares 1" 8-channel tape **DIRECTLY** from the draftsmen's art work at a **LOW INITIAL** and **LOW UPKEEP** cost.

ELIMINATE MASTER BOARDS and **SAVE** by preparing tape directly from art work. **HIGH SPEED PERFORMANCE** locates up to 30 positions per minute. **MAXIMUM ACCURACY AND RELIABILITY** are the result of the unique design which corrects errors in the art work and keeps the programming process on the desired grid automatically. **INDEPENDENT OPERATION** permits tapes to be prepared when drilling machine is in use. **COMPLETE VERSATILITY** is provided by precision interchangeable slides allowing the Programmer to handle grid sizes down to .025" including unusual grids.

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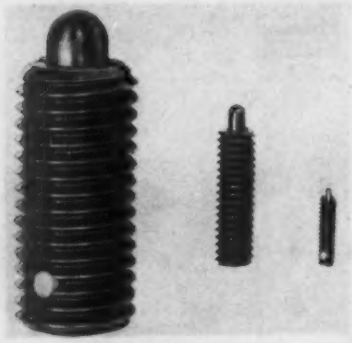


Spring Plungers Lock By Nylon Insert Action

Nylon pellets are incorporated in a complete line of spring plungers for use in dies, jigs, fixtures, and detents. When the plunger is in place, compression of the nylon pellet, called Nylock, creates a spring-like wedging action that locks the mated threads together.

Nylock inserts eliminate the need for setscrews or other methods of locking. Self-locking torque of the inserts provides a positive lock that is vibration proof. Plungers are available in thread sizes from 6-32 through 1 in. to 8 in.

Harco Engrg, 12092 Woodbine Ave, Detroit 39, Mich

MORE DATA? Circle 96, inside back cover

Rust Preventive Doesn't Stain

Cleaner named D-6882—researched and developed at the company's laboratory—is said to have good cleaning properties, to impart an adequate film for rust protection, and not to stain machined parts. Technical data sheet is available.

Kerns United Corp, 2659 E 95th St, Chicago 17, Ill

MORE DATA? Circle 97, inside back cover

All-State Introduces Copper and Aluminum Bronze for Mig Weld

Spoolarc deoxidized copper for Mig welding applications is available in 0.035, 0.045, 1/16, and 3/32-in. sizes.

The wire, which can be used for joining copper to mild steel or to copper and bronze alloys, or copper bus bars is said to be free-flowing and to produce strong, ductile welds which maintain a high electrical conductivity rating.

Also introduced is Spoolarc aluminum bronze for joining of bronze to copper or low alloy and carbon steels to stainless (18-8). It also is said to be excellent for surfacing steels. Tensile strength is more than 60,000 psi with 60% elongation characteristics. It is available in the same sizes as the deoxidized copper.

All-State Welding Alloys Co, Inc, White Plains, NY

MORE DATA? Circle 98, inside back cover

Adhesive Gives Strong Bonds That are Permanently Flexible

Said to be the strongest flexible adhesive available today, CD cement 350 can be used for bonding natural and synthetic rubber, vinyl plastic, fabric, leather, wood, glass, steel or aluminum. The high-solids adhesive is permanently flexible and is waterproof, exhibits good oil and chemical resistance.

Available in quarts, gallons, five gallon and drum quantities, it can also serve as waterproofing for electrical systems.

Chemical Development Corp, Danvers, Mass

MORE DATA? Circle 99, inside back cover

Magnus Electro Cleaner Prepares Metals for Electroplating

Magnus 24Y is a new electrocleaning chemical designed for anodic and cathodic cleaning of steel, iron, stainless and copper prior to electroplating.

It is used in a mixture of 8 to 12 oz per gallon of water at temperatures ranging from 190 to 200 F. Depending on the current output of the electrical system, 40 to 100 amperes per sq ft are used. Cleaning time is from 30 seconds to 3 minutes depending on soil, current density and cycle requirements.

The cleaner is said to give good rinsability, and to emulsify and prevent redeposition of oils.

Magnus Chemical Co, Inc, Garwood, NJ

MORE DATA? Circle 100, inside back cover

Coating Prevents Oxidation of Molybdenum at High Temperatures

Coating for molybdenum, which oxidizes at high temperatures, gives the metal resistance to erosion at temperatures as high as 3800 F. Called Durak-B, the material forms a mixture of refractory intermetallic compounds on the surface of the base metal to protect it from erosion.

In a demonstration, a heavy weight was suspended from a molybdenum wire and the wire was then heated to over 2000 F. There was no stretching or smoking of the treated wire although a bare wire would reportedly break under similar conditions.

The Chromizing Corp, Subs of Chromalloy Corp, Hawthorne, Calif

MORE DATA? Circle 101, inside back cover

Vascoloy-Ramet Titanium Carbide Tools Outlast Conventional Carbides 15 to 1

Titanium carbide tool bits, first developed by Ford Motor Co in 1959, (See *AM/MM* Mar 23 59 p125) are now being produced under license by Vascoloy-Ramet. The titanium carbide bits, which will outlast conventional carbides by up to 15 times in some applications, are normally made of 80 percent titanium carbide and 10 percent each of nickel and molybdenum. Hardness of the bits is around Rh 92 C.

Tests of the material, known as VR-65, show marked performance advantages over conventional carbides. Mild steel has been cut at 600 to 1800 sfpm to an average finish of 12 RMS with tool life 15 times that of the previous tools used for the job. Tool life on 300-series stainless cut at 250 to 700 sfpm was 8 to 10 times that of previous tooling and surface finish obtained was 20 RMS. Other metals such as Monel, Ilium alloy, cast steel, cast iron and heat-treated steel at Rh 40C showed similar results when cut with VR-65.

VR-65 tools are available in either negative or positive rake, mechanically-held inserts. Also available are blanks that can be brazed to steel shanks and single point tools. Tool geometry is the same as used on conventional carbide tools.

The high surface speeds possible with the titanium carbide tools give improved surface finish and cut down on subsequent grinding. A 316 stainless part run at 0.0008 in. feed, 0.003 in. depth of cut at 760 sfpm can be turned to a surface finish of 3-5 RMS.

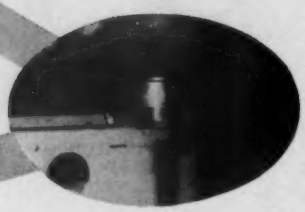
Another gain for the new tooling is improved size control. Because of the high edge wear resistance of titanium carbide tooling, as many as 350 pieces have been machined to accurate tolerances without reset of the machine stops where conventional tooling required reset every 25 pieces.

Vascoloy-Ramet Corp, Waukeegan, Ill

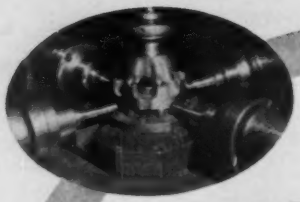
MORE DATA? Circle 102, inside back cover

Precision finishing

All around your shop...



General purpose machining



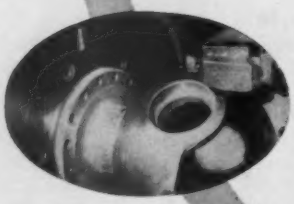
Finishing or light roughing

16 V-R carbide grades give complete machining flexibility

Heavy-duty roughing

Each V-R carbide grade is created with its own special combination of hardness, toughness and heat resistance. Sixteen such individual grades, plus a ceramic grade, bring you complete machining flexibility. You'll find the exact combination of tooling characteristics for your job regardless of the operation to be performed or the material to be machined. V-R's rigid quality control assures you of the same consistent, superior performance every time. Ask your V-R man to help you select the V-R cutting tool that's best for your job.

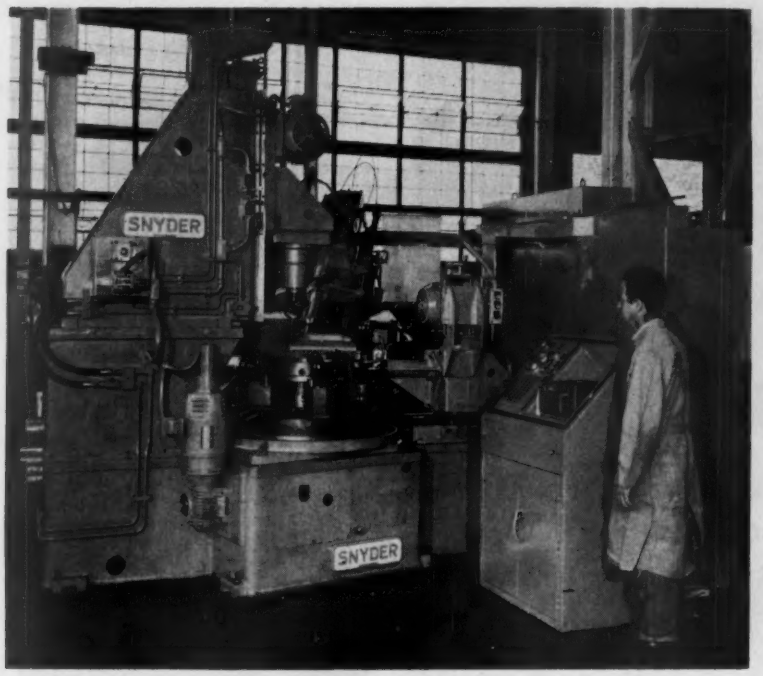
VASCOLOY-RAMET CORPORATION
818 Market Street, Waukegan, Illinois.



Interrupted cuts

V-R FIRST CHOICE in more and more plants

C-852



Snyder Applies N/C Tape to Multi-Head Dial Machine

Snyder Corporation's first numerically sequenced machine tool is a multi-head dial unit tooled to drill, ream, and counterbore radial and vertical holes in cast iron diesel flywheels for Buda Corp. A General Electric Mark I punched tape system controls index table positioning and initiates automatic feed cycles of all machining heads.

Table indexing is unusually fast—2 rpm. Even at this speed, the table will position a 32-in.-diameter workpiece within plus or minus 0.0005 in. Workpieces machined in the unit to date are smaller than 32 in., and accuracy on their OD's is even better.

Drive is from a numerically controlled amplidyne motor, through a set of ground-and-lapped spiral bevel gears, to a pair of non-reversing, double-enveloping worms located 90° from each other. These worms power a worm gear attached to the bottom of the indexing table, and complete the adjustable, no-backlash drive.

Numerical control works through a selsyn driven by a 32-in. fine-pitch instrument gear attached to the table. Selsyn feedback signals control the amplidyne motor to slow it as the 34-in.-diameter table approaches the index position, then stop it at exact position without overshoot. No shot pins or braking devices are involved.

In the diesel engine-flywheel application illustrated (above right), the machine is fitted with one vertical machining unit, one angular-mounted machining unit, and two horizontal machining units—all standard Snyder way-type units with hardened and ground ways, automatic lubrication, and motorized spindles. Process tapes for 15 different flywheels, ranging in diameter from 12⅝ to 20 in., have been made so far.

Some flywheels require two machining setups, others demand three, depending on the centerline heights of the various holes required in the flywheel rim.

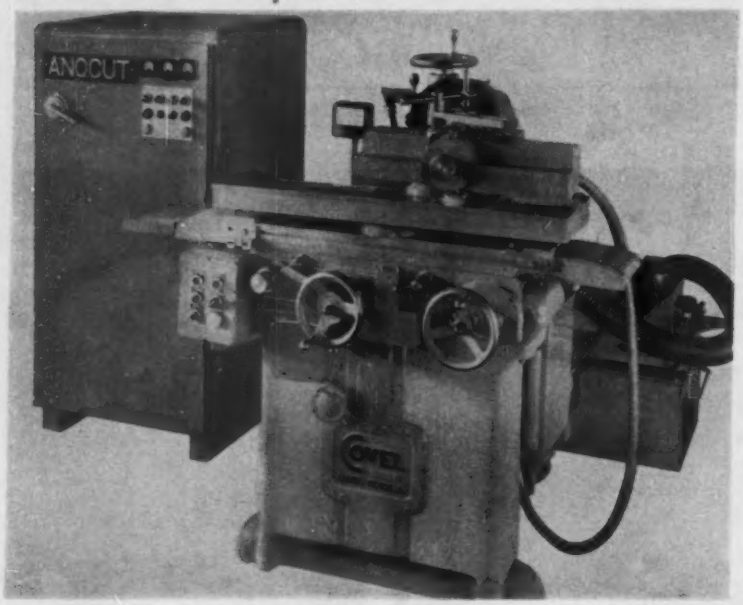
On a typical flywheel, the first setup will have the vertical spindle counterboring six 1½-in. holes, and the two horizontal spindles drilling and core-drilling ten radial 1-in. holes in the rim. The second setup is made with new tools in the horizontal spindles and with spacers in the index-table fixture that change the part height. Then the angled spindle drills three ⅜-in. holes in the rim, one horizontal spindle drills eight ⅝-in. holes in the rim, and the remaining horizontal spindle reams the eight holes. In any operating sequence, one or more of the spindles may be in operation.

The numerically controlled dial machine includes a hydraulic power pack, a control console, and electronic and electrical control panels. The console includes a tape reader, decade pushbuttons for manual control of any function, indicator lights, and an emergency stop control. One pushbutton on the console returns the index table to zero position whenever desired.

Feed rates and travel lengths are adjustable for any of the hydraulically actuated slides.

Snyder Corp, 3400 E Lafayette Ave, Detroit 7, Mich

MORE DATA? Circle 51, inside back cover



Covell Electrolytic Cutter and Tool Grinder Gives Fast, Cool Stock Removal

This new model 12 B electrolytic cutter and tool grinder is especially designed to be used with the Anocut Electrolytic power unit. Advantages claimed for the machine are: 1) faster grinding (from 2 to 5 times faster stock removal than with conventional diamond wheels), 2) increased diamond wheel life (from 5 to 10 times that of conventional methods), 3) practically no heat is generated so that grinding cracks in the carbide rarely occur. In one test an 8-in. carbide face mill was sharpened with stock removed at a rate of 0.001 in. per second.

The spindle is equipped with brushes and a slip ring to carry the current from the power pack through the spindle and to the metal-bonded diamond wheel (minus side). Since the workpiece is the plus side, the spindle is insulated from the rest of the machine. The spindle has an air operated automatic indexing device that makes it unnecessary for the operator to touch the work or the work head during the grinding.

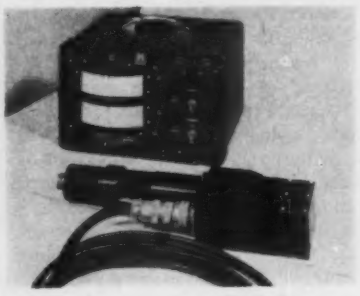
Air-operated automatic infeed with hydraulic check gives rapid approach, adjustable feed and automatic return controlled by a microswitch with micrometer setting. This assures constant pressure between the wheel and the work, allowing the fastest electrolytic action.

The table has an automatic reciprocating movement with adjustable stroke from 0 to ½ in. at a rate of 43 strokes per min. Electrolyte is flowed between the wheel and the work by a system comprising a stainless steel tank, pump, splash guards and drains. In addition, an exhauster is connected to the wheel hood to create a vacuum at this point so that spray from the wheel will be withdrawn from the operating position.

A ring of bristles on the wheel confines the electrolyte but allows the cutter to be brought to the wheel.

Covell Mfg Co, Benton Harbor, Mich

MORE DATA? Circle 55, inside back cover



Heald Gage Locates Tool Point Position Within 0.000025 inch

The Tool-Tronic is a combination optical and electronic device that will determine location of a tool point within 0.000025 in. in relation to a workpiece. It consists of two basic units, a gage-sensing head and a reading cabinet housing an electronic amplifier power supply and two tool-location indicating meters. The gage-sensing head contains light source lenses and photosensing cells. When a tool is placed in an orifice in the gage-sensing head it interrupts a part of the light rays passing from the source to the photosensitive cells. The distribution of the remaining light by-passing the tool is picked up by the cells and these cells relay the tool position infomation to the two meters in the cabinet. Zero readings on the X and Y axes are reached by moving the tool with machine table and cross slide. The tool point is then in position at a known location with reference to workholding-spindle centerline and flange face.

Since no contact is made with the tool point in this system, damage to tool points is eliminated. In addition, the combination of electronic and optical measuring techniques eliminates the "eyeballing" normally associated with purely optical systems.

The Heald Machine Co, Worcester, Mass

MORE DATA? Circle 56, inside back cover

Magnetic Chuck Has Close-Spaced Poles For Machining Small Work

Micro-Mesh permanent magnet chuck has a new close-spaced pole arrangement with barium-ferrite (ceramic) magnets. This allows machining of work as thin as 0.001 in.

Sliding tests on the chuck show a holding power of 2½ lb per sq in. for a piece 0.008 in. thick. This is said to be about 250 percent more power than conventional chucks can exert.

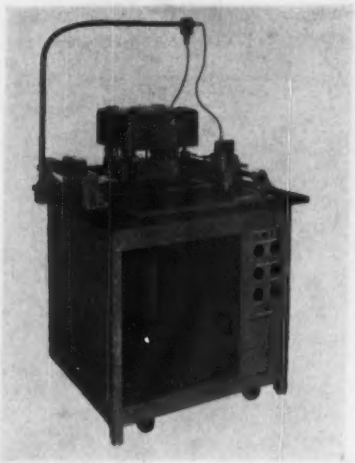
Because holding power over the entire magnetic surface is uniform—the usual weak zone by the handle area has been eliminated by locating the handle shaft support mechanism on the chuck exterior—the chuck can be used fully loaded for maximum production.

The chuck has 6 by 18-in. working surface, 6 by 15¾-in. magnetic surface, and 6 by 18-in. base dimensions.

Height is 2½ in. and length is 22 7/16 in.

Brown and Sharpe Mfg Co, Industrial Products Div, Providence 1, RI

MORE DATA? Circle 57, inside back cover



Printed Circuit Board Drill Makes 25,000 Holes per hr

Quad-Drill, a circuit board drilling machine, will produce clean, burr-free holes at the rate of 25,000 per hr when stack drilling with four spindles. Hole location is maintained within 0.001 in. of true template position.

The unit is a free-moving coordinate axis machine that permits two-directional positioning of a central drillhead over desired locations.

The drill head has four spindles, each located on a corner of a 10 in. square so that four 10 by 10 in. boards can be drilled at one time.

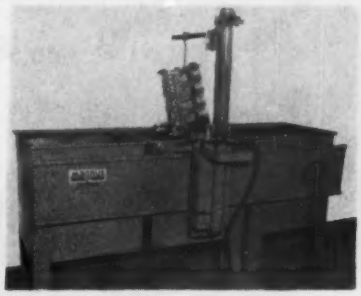
Head positioning is accomplished by inserting a stylus into a predrilled template. This is done with a hand grip which, when squeezed, lifts the stylus clear of the template, releases the brake system, and allows the operator to move the machine to its next position. Releasing this hand grip lowers the stylus into the template. To prevent drilling when out of position, drilling cannot begin until the stylus is firmly seated in the center of a template hole.

Each spindle is equipped with a drill bushing pressure-foot-switch that actuates feet which apply a 75 lb compressive force to the boards before the drill enters the work.

Drill stroke speed is adjustable from 0 to 35 ipm and drill speed, from 0 to 21,000 rpm.

Excellon Industries, 5002 Crenshaw Blvd, Los Angeles, Calif

MORE DATA? Circle 58, inside back cover



Tramway Unit Speeds Multi-Tank Cleaning

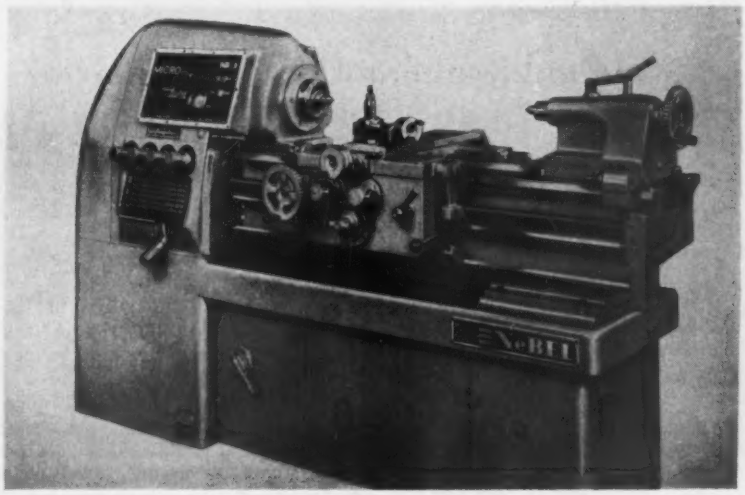
The Porto Lif for all multi-tank cleaning is a 75-lb-capacity, lever-controlled, pneumatically operated unit that provides 100 to 140 up-and-down motions per minute in the cleaning solution. Agitation of the suspended, basketed, or platformed parts in the solution insures thorough cleaning of all recesses of the parts.

Work is loaded on the platform of the unit at floor level, pneumatically raised and manually rolled into position over the first tank. A lever lowers the platform into the tank of cleaning solution and automatically starts the agitation. At the end of the cleaning period, the platform is raised and the unit rolled into position over the next tank for an agitated rinse.

The Porto Lif can be adapted to perform any number of operations such as pre-wash, wash, rinse, anti-rust, and dry. It can be purchased for use with existing tanks; as a complete unit with desired number of tanks; or for mounting on 30 and 55-gal drums.

Magnus Chemical Co, Equipment Div, Dept M-88-1, Garwood, NJ

MORE DATA? Circle 59, inside back cover



Nebel Lathe Delivers Constant Horsepower Throughout Entire Range of Spindle Speeds

High speed precision lathe that features infinitely variable spindle speeds from 43 to 3500 rpm with constant horsepower, the Micro-turn maintains output speed within two tenths of one percent. This is said to provide maximum torque at lowest speeds for heavy cutting, plus precision balance and minimum vibration at high speeds so that fine finishes can be obtained.

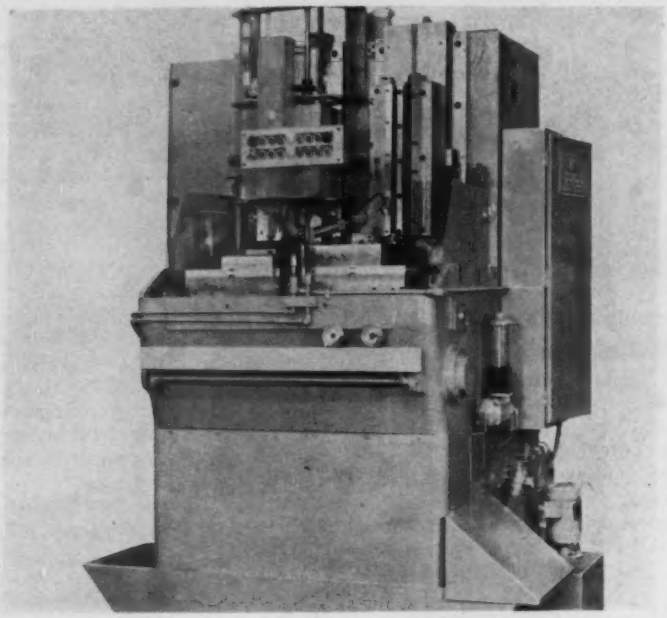
In the low speed range, up to 400 rpm, the lathe operates through a planetary gear unit. In the high speed range, head stock coaxial sections lock into a single unit and the lathe operates through matched multiple vee belts directly from main drive to spindle.

Shifting between high and low speed ranges can be done while the spindle is rotating or stationary through centralized pushbutton controls and a direct reading tachometer.

The totally enclosed pressure-lubricated gear box gives 60 thread and 60 feed changes and the standard thread range from 4 to 240 threads per inch includes standard pipe sizes of 11½ and 27. Standard feeds range from 0.0005 to 0.0337 per revolution.

The Nebel Machine Tool Corp, Lathe Div, 3413 Central Parkway, Cincinnati, Ohio

MORE DATA? Circle 60, inside back cover



Vertical Dual-Ram Broaching Machine Does Work of Two Single-Purpose Units

By performing the same amount of work that would normally tie up two machines, this new, standard, 5-ton, 42-in. vertical dual ram, combination surface and internal broaching unit can cut overhead costs and direct labor costs by 50 percent.

The machine operates at speeds of 45 fpm and can perform two different operations on different workpieces or on the same workpiece. Only one operator is required, mainly to load and unload parts. Alternating action of the machine's rams enable the operator to load and unload one ram position while the other is broaching. Volume of production depends on shape, size and material of the part. To rough and finish broach a keyway in a round steel refrigerator compressor component and remove three lugs from its circumference with slabbing broaches, the machine can operate fast enough to turn out 188 pieces per hr, at 70% efficiency.

Left to right adjustment of the slides is done with one way on each side of the machine, and front to back positioning is provided for by full length adjustable gibs in the slides.

As an optional feature, a ram stabilizer can be provided to hold the main slides against one "dead" way surface during the cutting stroke, and this holds runout of the slides to 0.0005 in. TIR.

Detroit Broach & Machine Co, Rochester, Mich

MORE DATA? Circle 61, inside back cover

Toolholder Allows Grinding Both Sides of Tool Without Resetting

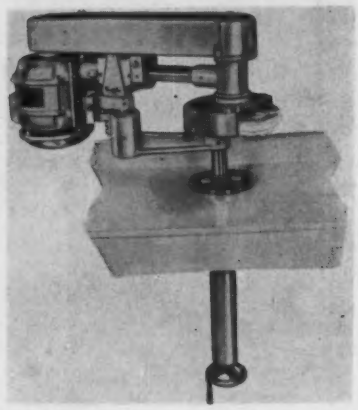
The Dern universal lathe toolholder does not require resetting to grind the second side of a tool. An operator sets the turret, which rotates 360 degrees, at the desired tool angle, inserts the tool, and tightens it. After one side of the tool is ground the tool holder is flipped onto the other side and a duplicate of the original angle is guaranteed, according to the manufacturer.

The holder, made of cast iron alloy, is designed in triangular form with an included angle of 60 degrees, and each side of the angle is compounded with a 5-degree clearance. Graduations on the holder are in 5 degree increments to 45 degrees with special indications at 14½ degrees to assure perfect settings for acme thread cutters.

Models 200, 500, 625, 750, and 1000 are available with capacities for tools of ⅜, ½, ⅝, ¾, and 1 in. respectively.

Dern Tool Co, North Hollywood, Calif

MORE DATA? Circle 62, inside back cover



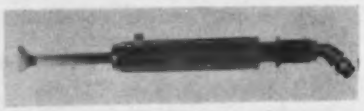
Bench-Mounted Finishing Units Are Universally Adjustable

The Flexi-Mount belt unit and Flexi-Mount wheel unit can be adjusted to any working height and angle. Both are single heads taken from the Nash multi-spindle rotary finishers and adapted to operate independently. Each is entirely self-contained with 1-hp electric motor, 3400 rpm, 220-440/3/60. Simple flange-type mounting with height-adjustment wheel makes it easy to move the units from one job to another.

The wheel unit will take buffing wheels, wire wheels, Tampico wheels, nylon pile wheels, flat wheels, and others up to 10 in. in diameter. The belt unit offers a wide range of horizontal, vertical, and angular settings. It operates abrasive cutting belts, buffing belts, or polishing belts 2 in. wide and 60 in. long at 3400 sfm.

J M Nash Co, 132 Jackson St, Oshkosh, Wis

MORE DATA? Circle 63, inside back cover



SCALING HAMMER is useful for removing metal splatter after welding, scaling off old paint and rust, cleaning sand from small castings and general beading, peening and star drilling. The 11-in. long tool weighs four lbs and delivers 4600 blows per minute—*The Airtool Mfg Co, Springfield, Ohio*

MORE DATA? Circle 64, inside back cover

You cannot afford to ignore the New Allen-Bradley BULLETIN 709 Starter Line

SIZE 00
1½ HP, 220 V
2 HP, 440-550 V

SIZE 0
3 HP, 220 V
5 HP, 440-550 V

SIZE 1
7½ HP, 220 V
10 HP, 440-550 V

SIZE 2
15 HP, 220 V
25 HP, 440-550 V

SIZE 3
30 HP, 220 V
50 HP, 440-550 V

SIZE 4
50 HP, 220 V
100 HP, 440-550 V

SIZE 5
100 HP, 220 V
200 HP, 440-550 V

They OUTPERFORM and OUTLAST ALL Others

These new Allen-Bradley starters bring you the greatest advance in reliability and life in all motor control history. Also, they possess a compactness that's almost unbelievable—especially in the higher ratings.

The new Bulletin 709 solenoid starters feature a patented, high-efficiency magnet, which is cushioned to reduce shock and wear. Contacts are of weld-resistant cadmium oxide silver. All coils are "pressure molded" for protection against physical damage and destructive atmospheres. The two or three solderpot overload relays are trip-free and tamperproof. Brooks Stevens, famous industrial designer, has given the new enclosures a styling that adds "eye appeal" to every installation. To get full details, contained in Publication 6100, please write today to: Allen-Bradley Co., 1316 S. Second Street, Milwaukee 4, Wisconsin.

SIZE 00 NOW AVAILABLE

Provides the same long life and reliability as others in the Bulletin 709 family. Rated 1½ HP, 220 V; 2 HP, 440-550 V.

15-61-MR

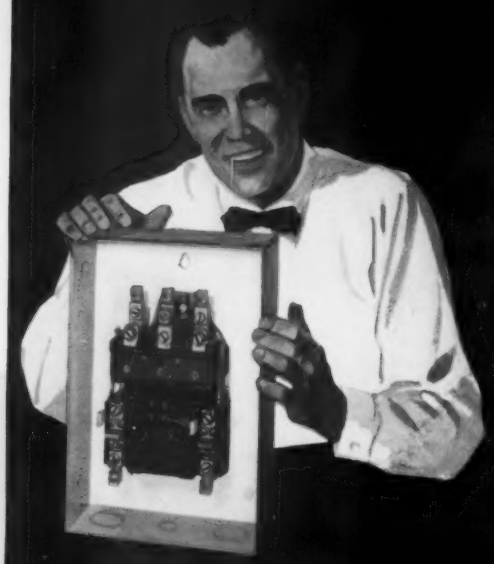
ALLEN-BRADLEY

Member of NEMA

QUALITY MOTOR CONTROL

Here Your Motor Starter Dollar Buys

MORE OF THE QUALITIES YOU NEED



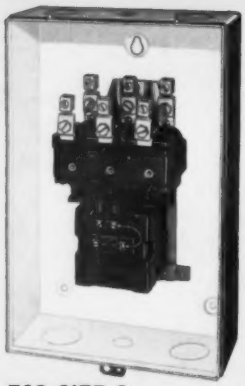
BULLETIN 709 SIZE 3
across-the-line solenoid starter in Nema Type 1 enclosure.

Where else could you possibly obtain—in one complete line—all of the desirable features of the ideal motor control...

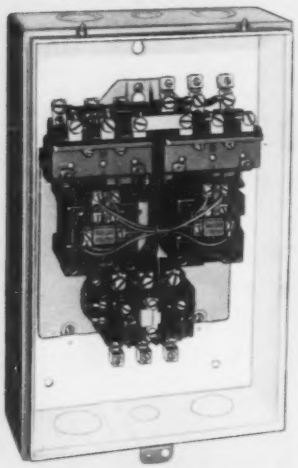
1. **Smaller size**
2. **Greater reliability**
3. **Remarkable switching capacity**
4. **Longer life**
5. **Conscientious overload protection**
6. **Simpler installation**
7. **Complete accessibility**
8. **Beautiful appearance—either open or enclosed**
9. **Surprising light weight**

The heart of this new line of magnetic motor starters is the unique solenoid contactor. While it retains the famous A-B one-moving-part principle, it is completely new and far more efficient. This fact is reflected in reduced dimensions for all of these controls. Yet, this contactor design will perform reliably for many more *millions* of trouble free operations.

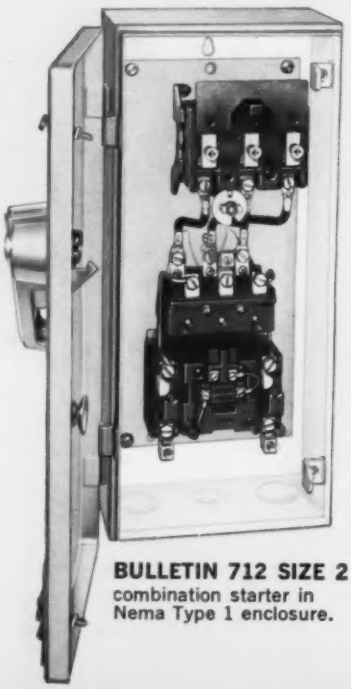
The new enclosures are very "eye appealing." When the open type starters are assembled into special panels, their neatness and compactness will delight the designers. Full details are in Publication 6100. Please write: Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.



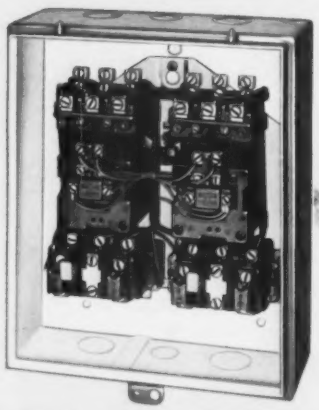
BULLETIN 702 SIZE 3
three-pole, a-c solenoid contactor in Nema Type 1 enclosure.



BULLETIN 705 SIZE 2
across-the-line reversing starter and overload relays in Nema Type 1 enclosure.



BULLETIN 712 SIZE 2
combination starter in Nema Type 1 enclosure.



BULLETIN 715 SIZE 1
across-the-line, two-speed starter—with two overload relays per speed—in Nema Type 1 enclosure.

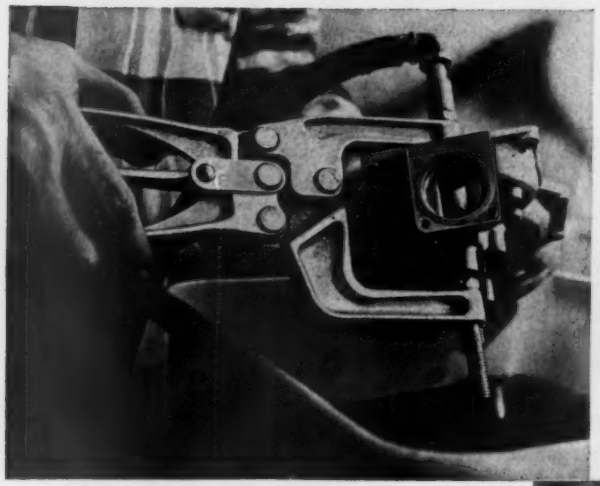
15-61-MR

ALLEN-BRADLEY

Member of NEMA

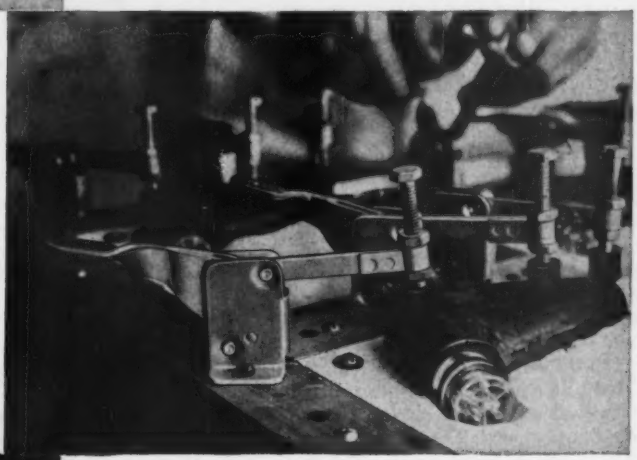
QUALITY MOTOR CONTROL

Look what clamps are doing!



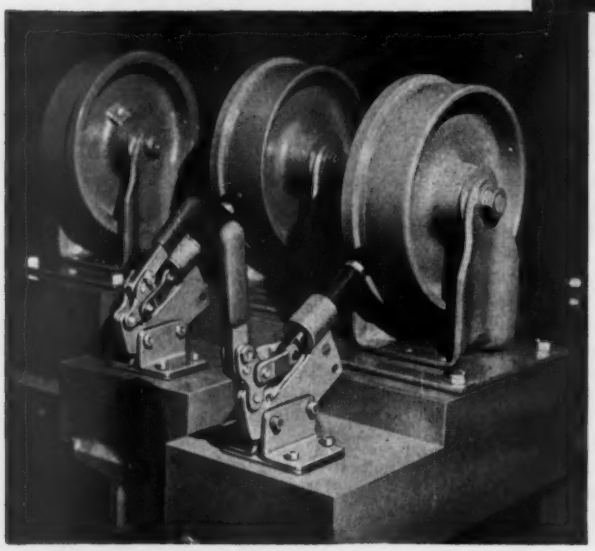
Practical uses of Wespo Toggle Clamps and Pliers that may suggest ways you can save

Toggle plier serves as low cost fixture for testing castings The air line is connected through one jaw of a Wespo Model 522 Toggle Plier. The plier is then clamped onto the casting and air applied by a foot control. Immersing the casting into a tank quickly spots any defects. Patented "Quick trigger" feature of the Model 522 instantly releases the casting; speeds testing. Rugged, lightweight Wespo toggle pliers are available in various jaw capacities and sizes.

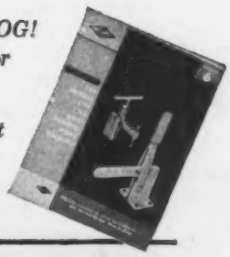


Holding these glued parts together while drying is a simple task with Wespo Horizontal Bar-Type Toggle Clamps. Neoprene-capped spindles prevent damage to plastic surfaces, yet securely hold the parts during the drying operations. Wespo toggle clamps are available in more than 80 types and sizes. So, the next time you think clamps, think Wespo!

Simple, low cost "parking brake" for this track-operated frame is provided by a Wespo Push-Pull Clamp equipped with a neoprene-capped spindle. "Brake" is quickly applied or released by a simple flick of the wrist. Wespo Push-Pull Clamps are available in various sizes and holding pressures and are ordinarily used on holding fixtures where push or pull clamping is required.



FREE CLAMP CATALOG!
Ask your Wespo distributor for your free copy of this 16-page Wespo catalog. It will help you quickly select the right clamp for every clamping job.

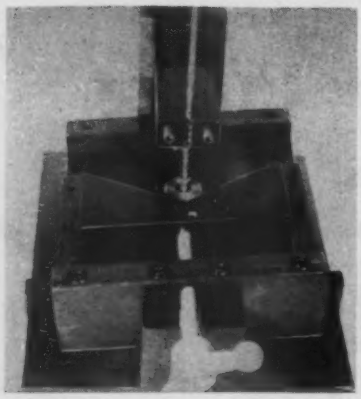


WESPO

DIVISION OF VLIER ENGINEERING CORPORATION
26935 W. Seven Mile Rd., Detroit 19, Michigan
Formerly West Point Manufacturing Company

◄ CIRCLE 342 READER SERVICE CARD

CIRCLE 343 READER SERVICE CARD



Universal Broaching Fixture Assures Anti-Backlash Keyways

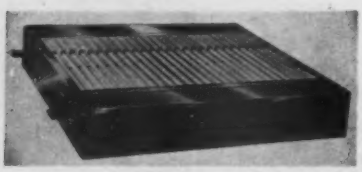
New universal broaching fixture allows slot broaching as well as broaching of keyways to take anti-backlash Sur-Lok double taper lock keys. Adaptable for arbor broaching or broaching machines, the fixture comes equipped with a standard straight centerline broach head and insert. Broach heads, paired with proper inserts are available for most straight centerline keyway broaching and 5 degrees off-center broaching of slots in internal diameters from ½ to 4¾ in.

The fixture provides vertical adjustment of the broaching head for clearance of part up to 4-in. high and a threaded crank with a V-positioner locates and locks parts up to 6 in. in diameter against the insert for positive broach of the desired slot.

The table of the fixture can be tilted to 5 degrees by pushing on the push-pull positioning bar under the table until the table rests on the predetermined 5-degree surface of the bar. Pu'ling the bar out returns the table to a horizontal position for vertical slot broaching without moving the part.

The Sure-Lok Co, 7701 Melita Ave, North Hollywood, Calif

MORE DATA? Circle 65, inside back cover



High intensity Infra-red Ovens Developed by Fostoria

New techniques, using fluid cooling, now make possible very compact quartz lamp ovens and furnaces with extremely high heat transfer rates. Additional features claimed for this equipment are precision control with no contamination during processing. Almost any shape of equipment can be fabricated to meet nearly any requirement for high temperature (up to 3000 F) or for short cycles.

Fostoria Corp, Box 100, Fostoria, Ohio

MORE DATA? Circle 66, inside back cover

Gear Analyser Gives 3 Tooth Measurements Simultaneously

Nicks on tooth profiles as small as 0.0005 in. high are detected by this new Red Ring gear analyzer. The rolling-fixture type analyser works on inertial prinicples to give three simultaneous measurements of gear-tooth accuracy.

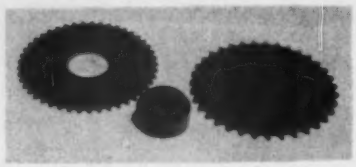
In operation, a pivoted motorized master gear is meshed with the gear to be inspected and the master gear is rotated. Center distance movements of the master gear are detected by three electrical indicators to give separate measurements of work gear tooth eccentricity, tooth-to-tooth variation and tooth oversize and undersize conditions.

Measurements of the electrical indicators are transmitted to a panel unit where one red light shows when a gear is rejected and another shows the particular error that caused the rejection.

A special feature of the machine is the indicator for the separate tooth-to-tooth measurement that uses an inertial type of mechanical movement to read only the high point of indication instead of following the entire in-and-out motion.

National Broach and Machine Co, 5600 St Jean, Detroit 13, Mich

MORE DATA? Circle 67, inside back cover



DIE-CUT SPROCKETS are available in Type A and Type B in various sizes with teeth numbers from 11 to 36 in larger size sprockets and from 12 to 112 in smaller sizes—*Dayton Rogers Mfg Co, 2824-13th Ave South, Minneapolis 7, Minn*

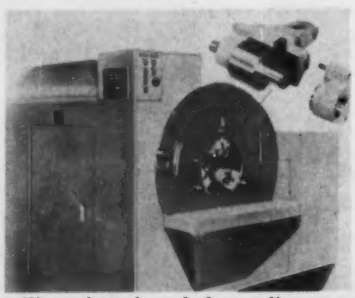
MORE DATA? Circle 68, inside back cover

Reed Thread Rolling Machines Have Parallel or Skewed-Axis Work Feed

Model AA33A three-cylindrical-die thru-feed thread rolling machine feeds work in with parallel axis or skewed axis rolling. For parallel axis rolling, a greater lead angle is used on the dies than that of the thread or form to be rolled; with skewed axis rolling, the axes of the dies are skewed between 0 and 5 degrees to feed the work while it is being rolled.

The machine is equipped with die holders designed to accommodate a 4-in. width of die. Powered by a 40-hp motor, it has a redesigned gear box to allow continuous thru-feed rolling of thread and form diameters from ⅝ to 2½ in. Diameter capacity of the machine when used for in-feed rolling is ¾ to 2½ in.

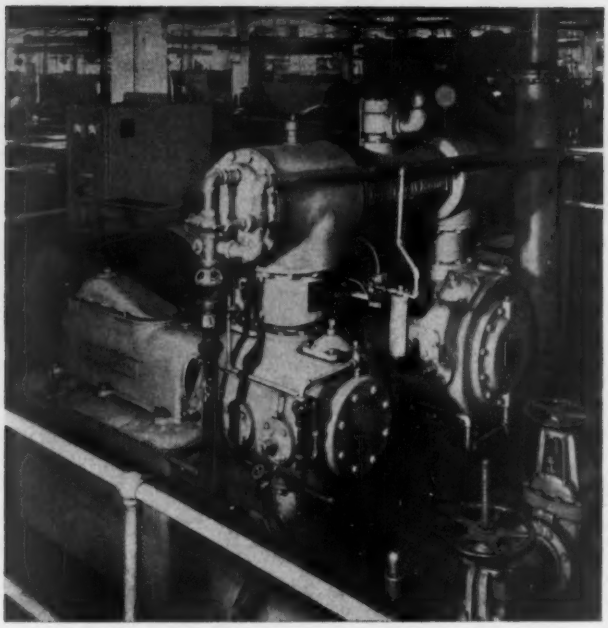
Model A34A is equipped with die holders for 5-in. wide dies. It also has a 40-hp motor, but takes heavier



rolling thread and form diameters than the A33A model. Diameter capacity of this machine is from ¾ to 4-in. for in-feed rolling and ¾ to 2½ in. for thru-feed rolling. Lengths up to 4½ in. can be accommodated for in-feed rolling.

Reed Rolled Thread Die Co, 791 Main St, Holden, Mass

MORE DATA? Circle 69, inside back cover



IN I-R COMPRESSORS,

TIME TELLS

THE DIFFERENCE

In this compressor, I-R Channel Valves have operated

13 YEARS

without maintenance or cleaning!

The 125-hp Ingersoll-Rand compressor shown above was installed in 1948 at the American Standard Industrial Division of American Radiator and Standard Sanitary Corporation, to provide 100-psi plant air power. Since that time, the compressor has operated from 12 to 24 hours a day, five or six days a week – and not a single valve part has been replaced, and the *valves never even had to be cleaned!* A couple of years ago the operator removed one valve from the machine for inspection, found it in perfect condition, and put it right back into the cylinder!

Ingersoll-Rand air-cushioned Channel Valves* have made many records like this. Ingersoll-Rand compressors now have many other *extra-value features*, such as full-floating aluminum bearings which never need adjustment, sealed frame which keeps out dirt (the major cause of wear), full filtered pressure lubrication, and self-adjusting metallic packing.

The extra value that's built into every type of Ingersoll-Rand compressor pays off with *long-run economy*. Reduced maintenance and attention, over many years, mean big savings in the cost of air power. I-R offers the most complete line of compressors—in reciprocating, centrifugal, axial-flow, rotary and thermal types. There are units from ½ to 25,000 hp, for pressures from one micron to 125,000 psi. Call your I-R man today for help on your job.

*** Only I-R compressors have Channel Valves**
Known for high efficiency, quiet operation and exceptional durability. Entirely different. Each valve is a combination of rigid stainless-steel channels and bowed leaf springs, with trapped-air spaces which cushion action, prevent impact. Separate stainless-steel seat plate may be turned over or replaced for new life.

Ingersoll-Rand
254A1 11 Broadway, New York 4, N.Y.

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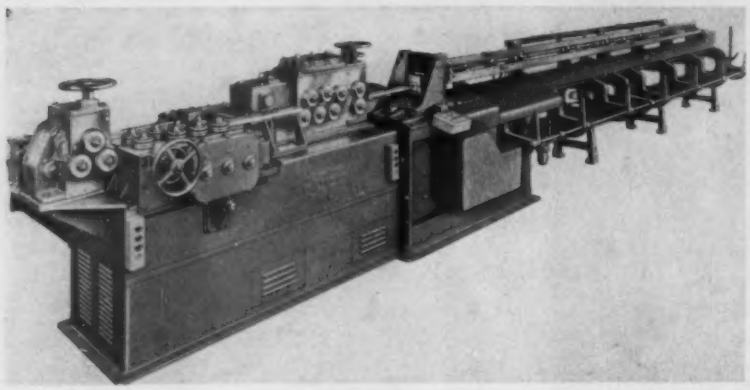


Shape Straightening and Cutting Machine Features Low-Inertia Flying Shear Cutoff

Low-inertia flying shear cutoff and a simplified electric trip mechanism that is independent of the gaging mechanism are two outstanding features of the No. 21-FHA travel-cut shape-straightening and cutting machine.

The cutoff travels with the rod and cuts while in motion. Its travel is controlled by a single crank-driven lever which also controls the vertical cutting stroke and eliminates all cams, springs and loose links. To eliminate feed roll marks on the rod and to give accurate synchronization of the cutoff head-speed with the feed speed a Reeves variable speed moto-drive independently drives the flywheel and cutoff.

Trip mechanism works when a rod or wire traveling through the split guide engages a limit switch finger and by electrical connection energizes the clutch and brake solenoid valves. The only inertia involved in this system is that of the limit switch finger.

The straightener consists of a three roll preliminary straightener to break the coil bow, an eight roll horizontal straightener for edge straightening, and an eight roll vertical straightener for finish straightening.

Capacity of the machine is 5/16 to 13/16 in. square or hex mild steel or an equivalent area in flats and shapes up to 2" wide.

The Lewis Machine Co, 3341 E 76th St, Cleveland 27, Ohio

MORE DATA? Circle 81, inside back cover

Feed Unit Gives Uniform Flow For Plasma, Flame-Coating Jobs

This compact Sylco CCC powder-feeder—which provides uniform, pulsation-free feed for metering precise quantities of very fine powders—is said to eliminate feed interruptions which waste expensive powders or cause inaccurate blending.

The powder-feeder consists of a pressurized canister equipped with a precision feed screw which carries the powder into a special carburetor. A carrier gas picks up the powder and conveys it to the point of application. Company says that it will give a uniform, unvarying feed rate whether canister is full or nearly empty.

Feeder will handle powders from coarse 80 mesh down through micron sizes—as long as they are perfectly dry and not deliquescent. Feed rate can be varied between 0.4 and 3.5 lb an hr for a typical aluminum oxide powder of 325 mish. Special lead screws can be supplied for feed ranges above or below standard.

Sylvester & Co, 17706 Miles Ave, Cleveland 28, Ohio

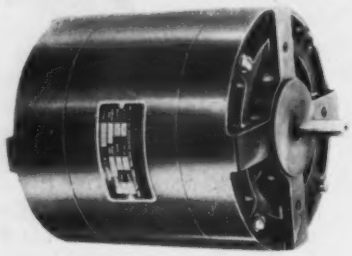
MORE DATA? Circle 82, inside back cover

Emerson AC Tig Welder Gives 13 to 295 Amp Welding Range

Designed for a welding range of 13 to 295 amps, the new Tig Weld 295 AC has fully rated duty cycles for tig welding of 40% at 200 amps or 30% at 295 amps. Other features include electrically controlled gas and water valves, high frequency intensity control, direct or remote operation, post flow control and pilot light.

The Emerson Electric Mfg Co, 8100 Florissant Ave, St Louis 36, Mo

MORE DATA? Circle 83, inside back cover



Ashland Introduces Line of Fractional HP, AC Motors

New line of 14 different fractional hp, 4⅜-in. dia ac motors are available in 4 types: low slip induction; torque; single, dual, and three speed hysteresis motors.

Operation is on 60 or 400 cycles, single, two or three phrase 115 volts or 120/208 volts. Horsepower developed, ranges from 1/150 at 900 rpm to ½ at 3300 rpm.

Housings for the motor are aluminum, cast around the laminations, and the end bells are die cast and rabbeted to the frame.

Ashland Electric Products, Inc, 32-02 Queens Blvd, LIC 1, NY

MORE DATA? Circle 84, inside back cover

Logan / 14" LATHES

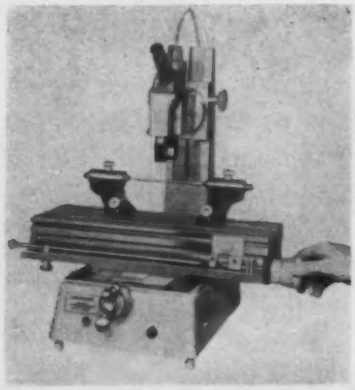
Accuracy is essential in a lathe. No one denies this. Yet accuracy alone isn't enough. It must be **sustained** accuracy. This requires holding exact tolerances during all machining operations and throughout the lathe's productive life. The new Logan 14″ swing lathes deliver this sustained accuracy. For example, these lathes have ball bearing variable speed drive for precise turning speeds. The drive can be adjusted at anytime to any rpm (40—1400) while the lathe is running. You **don't** stop to shift belts! Also, the ball bearing spindle's 1⅜″ bore and 1 1/16″ collet capacity will perform many different jobs. But, perhaps, your best assurance of Logan accuracy is the thorough testing—from headstock to tailstock—of **every** lathe before shipment. Write for specification-proof that Logan is your best dollar value in the lathe field.

accurate

Model 6510
$1,775.00
F.O.B. factory

Logan

LOGAN ENGINEERING CO., DEPT. G-861
4901 W. Lawrence Ave., Chicago 30, Ill.



Linearscope Measures Difficult Dimensions Rapidly, Accurately

Linearscope is said to make measurement of dimensions previously difficult to obtain, a rapid easy task. The scope can be used for scanning, scanning and measuring simultaneously, probing hidden recesses, and checking squareness factors external or internal. Internal measurements possible with linearscope include: dimensions between grooves, width and depth of grooves, diameters of beveled valve seats and size of ports.

The instrument is mounted on an internally ribbed base measuring 13 by 20 in. and weighs 150 lb. Its 6 by 20 in. tables are of Meehanite and stablized to prevent warpage. The lower tab'e rides on a wide V-way and top table is carried on two rows of ball bearings.

4-in. lateral movement of the table is controlled by a micrometer screw with readings direct to 0.0005 in.; 12-in. longitudinal movement of the table is controlled with gage blocks and a micrometer screw with readings direct to 0.0001 in. All T-slots are ground parallel with the table travel within 0.0001 in. in 20 in.

The head can be turned through 360 degrees and is calibrated 90 degrees on each side of the center with a 5-minute vernier. Eyepiece is inclined and has a 20 or 40X microscope with hairline reticle field of 0.488 or 0.240 in. respectively .

Image is erect and unreversed to simplify measurement.

Westwood Engineering Co, 2234 Purdue Ave, Los Angeles 64, Calif

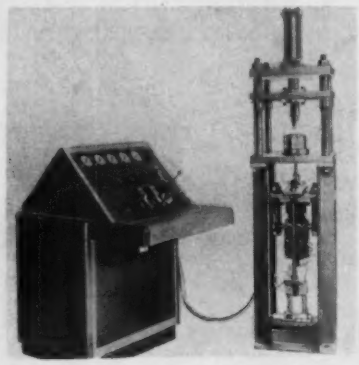
MORE DATA? Circle 85, inside back cover

3000-amp Magnetic Tester Offered in Smaller, Mobile Model

The Mobile Ferroscope operates on ac or half-wave dc and is said to be especially effective in detecting surface and subsurface flaws on parts too large for inspection on stationary wet horizontal units. Unit measures 23 x 37 x 37½ in., rolls easily on solid rubber casters, and weighs 600 lb, a quarter less than its predecessor. It can be rolled into tight corners by one operator.

Picker X-Ray Corp, White Plains, NY

MORE DATA? Circle 86, inside back cover



Vibrating Compaction Machine Delivers 20,000-G Acceleration

Greater pre-form densities in powdered metal ceramic and cermet components are said possible with the new VIV model 3 vibrator. The vibrator is capable of delivering 10 times the kinetic energy of a conventional vibrator of comparable size, according to the manufacturer.

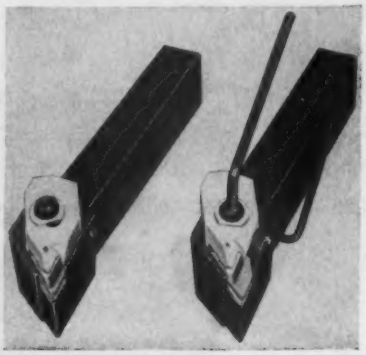
Accelerations greater than 20,000 g have been induced in powder specimens to achieve densifications over 90% of theoretical density.

The VIV has an operating range between 0 and 500 impacts per minute with air consumption reportedly 1/50 that of a standard vibrator.

The Branford Co, New Britain, Conn

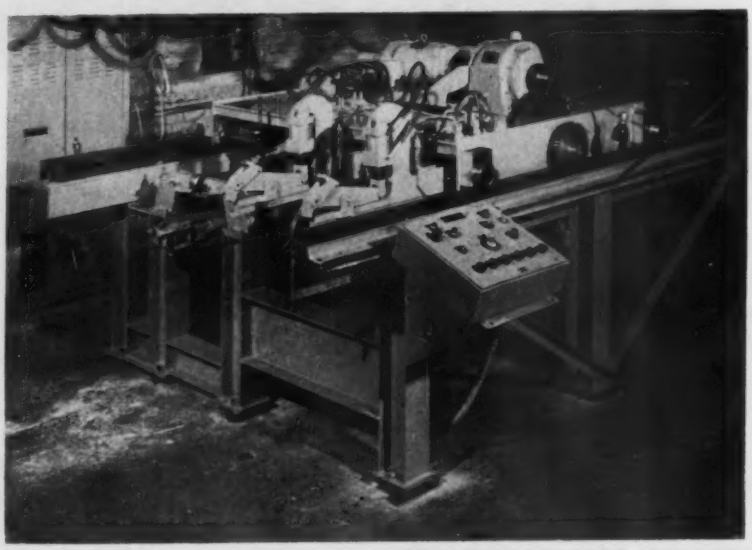
935

MORE DATA? Circle 87, inside back cover



NEGATIVE RAKE TRACER-TYPE Adjust-O-Breaker toolholders feature elongated diamond carbide insert so that it cannot twist out of holder when cutting load is applied. Holder is available in two styles and seven sizes *—Metallurgical Products Dept, General Electric Co, Detroit 32, Mich*

MORE DATA? Circle 88, inside back cover



NUMERICAL CONTROL OF SPACING TABLE carriage for punching structural shapes is possible with a GE unit that can be installed on Beatty Spacing table and punch machine. These punching machines feed structural beams up to 18,000 lb and to any length through a guillotine beam punch for punching rivet or bolt holes. Numerically controlled positioning permits spacing of holes 1/32 in. apart and operates both beam carriage and punch automatically—*Beatty Machine & Mfg Co, Hammond, Ind* MORE DATA? Circle 89, inside back cover

"I Know Every Tool Steel Grade and Size in Warehouse Stock"

Thanks to the Allegheny Ludlum STEELECTOR

"We simplified tool steel selection immensely when we started using the A-L STEELECTOR System. It slashed our selection time to seconds. And our local warehouse always has the grade and size we need in stock—ready for immediate delivery.

"Here's how we use the STEELECTOR System: We check bar graphs of the STEELECTOR Card for the job at hand (there are cards for hot work, high speed, and tool room grades) to compare the abrasion resistance, toughness, size stability, machinability, and red hardness of the STEELECTOR grades. In seconds we can pick the best combination of properties.

"We confirm our selection with the STEELECTOR Data Stock List. (There is a List for each STEELECTOR grade.) The Data Stock List itemizes every size and shape in stock. It tells us before we order that the particular grade and size we need is ready for immediate delivery. The STEELECTOR System and quick warehouse delivery have enabled us to reduce our own inventory.

"The Data Stock Lists also tell us proper hardening, tempering, and annealing temperatures. The steel analysis and AISI number are listed along with a description of the steel's properties. And a list of suggested working hardnesses for typical applications serves as a check on our use of the grade."

The STEELECTOR System is remarkably easy to use. If you haven't investigated it yet, ask your A-L representative for your copy of the colorful, 10-page STEELECTOR Booklet, or write: ***Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania.*** Address Dept. AM-8.

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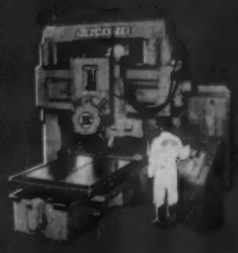
1500 parts programmed in tape.....

Model 2BHT-L
6 Spindle
¾" Drill & Tap Capacity in Steel
Table Travel 15" x 20"

Model 2S4HT
6-spindle,
1¼" capacity in steel. Table travel 15 x 25, 20 x 30, 30 x 45.

Model 3BHT
8-spindle, 1½" capacity in steel. Table travel 20 x 30, 30 x 45.



Model 3BHT
Double Hou
Planer Type
6-spindle,
1½" capacity
steel. Table tra
48 x 60"

CIRCLE 347 READER SERVICE CARD

PAYS FOR 4 MACHINES IN 1 YEAR

Saves $150,000 in Tooling Costs

* Collins Radio Company, Cedar Rapids, Iowa.

One Operator Controls Two Machines

At Collins Radio Company, Cedar Rapids, Iowa, approximately 1500 tapes have been prepared for use with the four Burgmaster Model 2BHT Tape-Controlled Turret Drills which they have in operation. Collins figures the difference saved between a tape and a conventional drill jig is $100.00, or a savings of $150,000.00 to date. This is in addition to the thousands of dollars saved in increased production, elimination of handling time, rejects, scrap and floor space. Another major savings innovation is Collins' assignment of a single operator to control two Burgmaster machines.

To the extreme left, 4 Burgmaster Turret Drilling Machines are being operated by only two men. Units #1 and #2 are banked at right angles for operator #1, and Units #3 and #4 are banked at right angles for operator #2.

Left, operator checks progress of Burgmaster Unit #2 as Burgmaster Unit #1 starts its pre-programmed cycle of machining operations.

World's Largest Builder of Turret Drilling Machines

"0" Manual Power Index ¼" Capacity

1C Manual Power Index ⅜" Capacity

2B Manual Power Index ¾" Capacity

2BR Ram Type Radial Drill ¾" Capacity

2BH Automatic Hydraulic ¾" Capacity

3BH Automatic Hydraul 1½" Capacity

2SAH Automatic Tape Controlled 1¼" Capacity

2BHT-3BHT Automatic Tape Controlled ¾" and 1½" Capacity

Send for Literature

Write for bulletin describing Burgmaster 6 and 8 Spindle Tape Controlled Turret Drilling, Tapping and Boring Machines. Forty minute 16 mm sound film showing all Burgmaster Turret Drills in operation is available without charge from any office.

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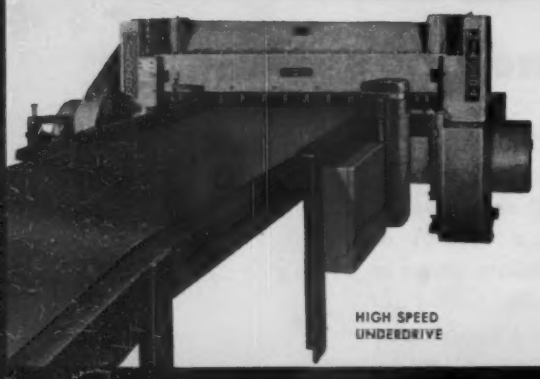
UNDERDRIVE

GAP TYPE



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Why compromise on a "nearly right" machine? Choose *Niagara* and you'll choose exactly what you need — for 1" plate or paper-thin sheet metal . . . short pieces or 20' lengths . . . automated high speed production or single stroke operation. Niagara has the world's largest selection of squaring and other types of shears . . . *nearly 150 models.*

Rugged underdrive and gap type giants for heavy industry and steel warehouses. "Middleweights" for medium gage material. Economy power and foot shears for the sheet metal shop. Slitting and ring and circle shears. Yes, even hand snips! There's no line like the Niagara line . . . *anywhere!*

Next time you need shears *of any kind,* take advantage of the greatest range and variety in the business. Select Niagara.

Keep the full Niagara shear story on file. Send for any or all of these bulletins:

Underdrive Power Squaring Shears (to 1" plate)	Bulletin 69
Power Squaring Shears with Gap (to ½" plate)	Bulletin 72
Power Squaring Shears (Medium Gage)	Bulletin 73
Power Squaring Shears (Light Gage)	Bulletin 71
Air Power Squaring Shears	Bulletin 87
Foot Squaring Shears	Bulletin 80

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America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work.

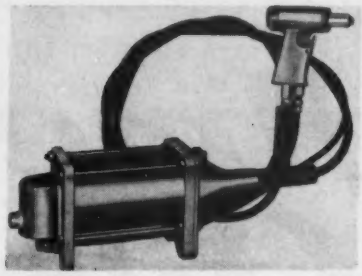
Croblox Gage Blocks Offered In Two New Series

The 28 Croblox (solid chrome carbide) Thin set (illustrated) inc'udes blocks ranging from 0.010 to 0.090 in. in A+, AA, and Laboratory Master accuracies. This series is designed for manufacturers who produce miniature precision parts.

Another series includes two sets, one of 11 and one of 21, and is available in five millionths and ten millionths steps in Laboratory Master grade. Linearity of the scale on electronic comparators or other instruments can be checked with these sets to an accuracy of less than one millionth of an inch. All blocks are rectangular style.

Webber Gage Co, Cleveland, Ohio

MORE DATA? Circle 103, inside back cover

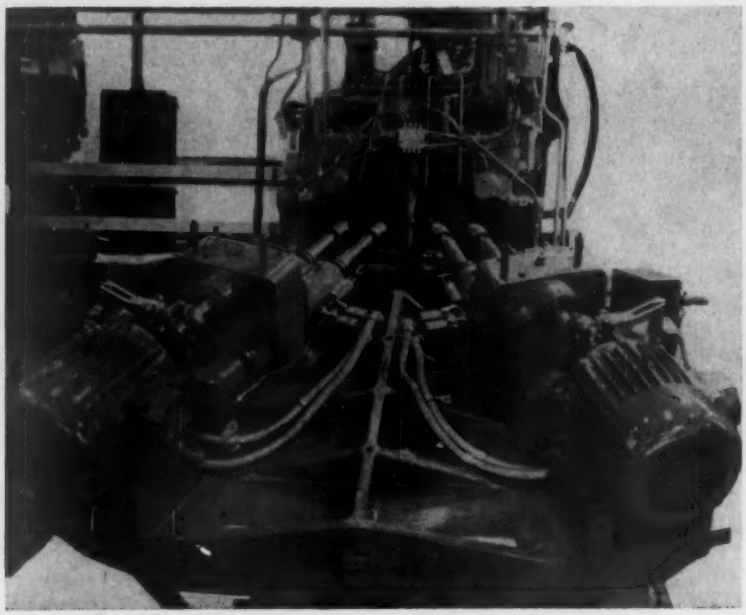


Lightweight Hydraulic Gun Sets Up to 1200 Pop Rivets per Hour

Model C is furnished with an air-to-hydraulic converter and operates from 75-psi air pressure. Increased power allows use of longer hose to increase the working radius. This 2-lb gun sets Pop rivets of all materials and diameters except ¼ in.

Pop Rivets, United Shoe Machinery Corp, Shelton, Conn

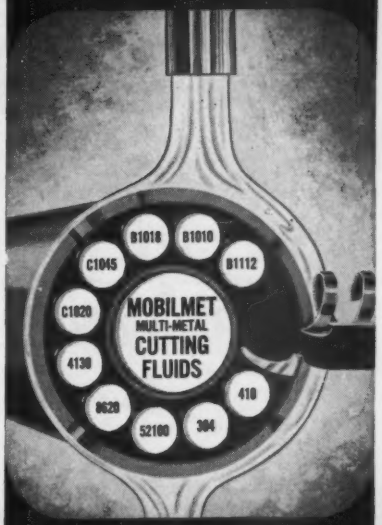
MORE DATA? Circle 104, inside back cover



DUAL-HEAD WAY UNIT developed to tap spark plug holes in aluminum cylinder heads for a high speed 90-station transfer line. Two lead screw units are doubled up on a single hydraulically-actuated feed carriage to shorten the line length by two stations and eliminate one transfer operation. The spindles are at an included angle of 46 degrees and angled 23 degrees downward. Taps are advanced alternately to tap the work and are stopped and reversed automatically. Tapping speed is 300 fpm for aluminum, but speeds as low as 70 fpm for cast iron can be obtained.—*The Foote-Burte Co, Cleveland, Ohio*

MORE DATA? Circle 105, inside back cover

SEE AD ON FOLLOWING PAGES...



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Mobilmet Oils

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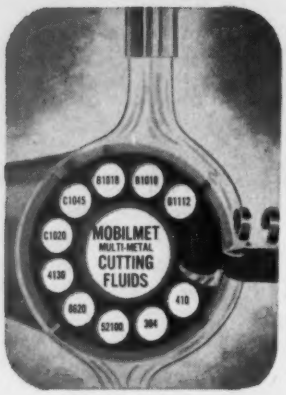

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Due to a unique additive combination, a single Mobilmet oil can be used on both soft, draggy metals and hard, brittle workpieces. As a result, there's less downtime for tool and cutting-oil changes. You get more production from each machine. And you save on handling costs, since you stock fewer oils. The wide range of Mobilmet applications includes: turning, drilling, boring, milling, gear hobbing, shaping and shaving, threading, tapping, pipe threading, surface and internal broaching, thread and form grinding, thread rolling, forming and special automatic screw machine operations.

Superior machining efficiency

In developing Mobilmet cutting fluids, Mobil research engineers made use of this Tapping Efficiency Tester to evaluate Mobilmet machining efficiency. In these tests and in field service on soft, draggy SAE1020 steel, new Mobilmet fluids out-performed cutting fluids designed specifically for this service.

Versatile new cutting oils offer you greater machine output, longer tool life, reduced loss from rejects, exceptionally wide range of applications! Now, after two years of exhaustive research and field testing . . . new Mobilmet* oils—the first multi-metal cutting fluids ever offered to the metalworking industry.

Mobilmet oils are uniquely versatile . . . help simplify your cutting oil requirements because each grade is effective over ranges of metals and operations beyond the capacity of any conventional product. And Mobilmet oils offer you superior machining results as well—in terms of improved finishes, longer tool life, and reduced staining.

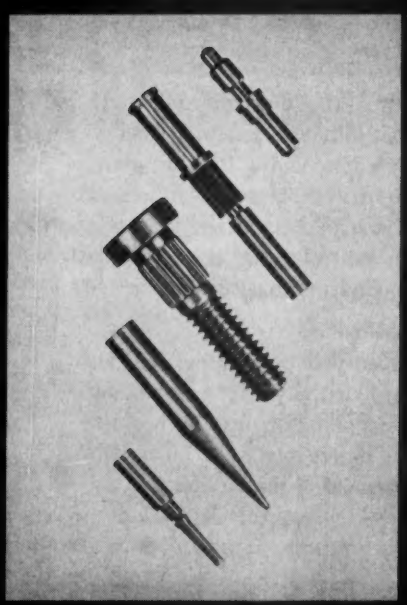
Behind this versatility and effectiveness: a new additive combination, developed and patented by Mobil, which is pressure-temperature selective in its activity and—highly effective over wide ranges of cutting pressures and temperatures. For complete information, call your Mobil Representative or use coupon on preceding page.

Mobil

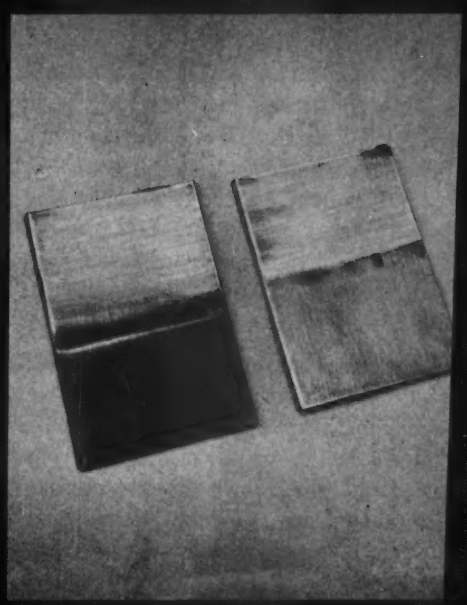
*Mobilmet is a trademark of Socony Mobil Oil Company, Inc.

MOBIL OIL COMPANY, 150 East 42nd Street, New York 17, N. Y.

Protected by heavy-duty Mobilmet, these pipe threading chasers, used for six weeks in moderately severe job-shop service, show little wear on either tool faces or thread crests. Mobilmet oils can mean longer tool life on soft or hard metals.



Because Mobilmet oils effectively control built-up edge and tool wear, you get superior finishes—fewer rejects. In some cases, Mobilmet oils reduce the need for additional finishing operations.

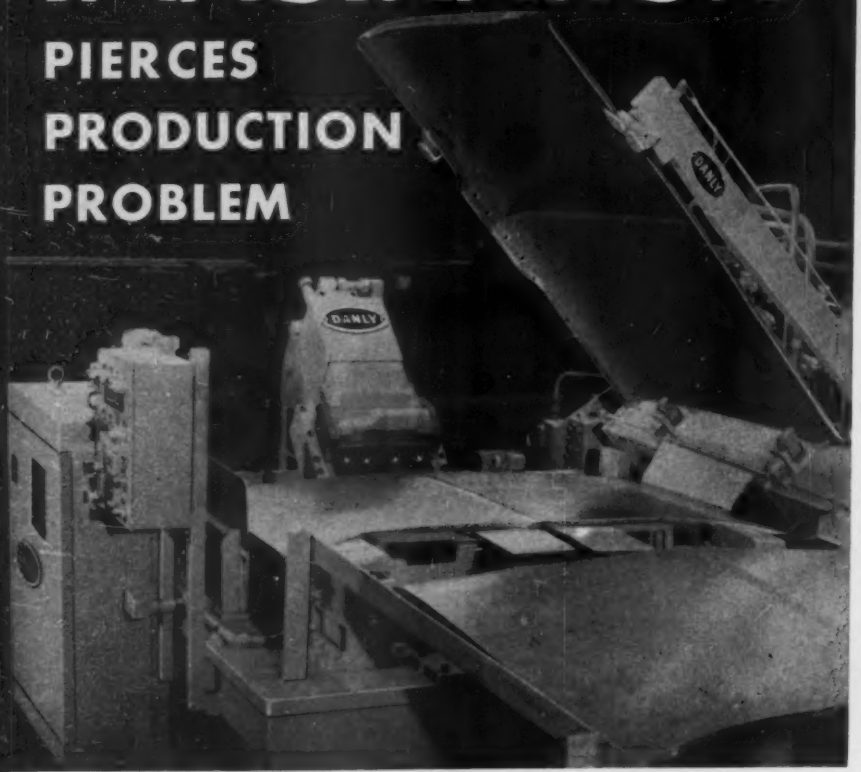


New additive combination in Mobilmet oils inhibits staining effect. Plate on left was immersed in conventional corrosive cutting oil; plate on right was immersed in heavy-duty Mobilmet suitable for same application. Repolished tops of plates show original condition.

DANLY

IMAGINATION

PIERCES PRODUCTION PROBLEM

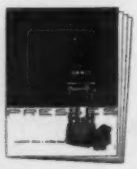


This Hydraulic Piercing and Turnover Unit, designed and built by Danly for a major automobile manufacturer, automatically pierces ornament mounting holes in hoods as they come off the forming press. And it handles 600 hoods per hour! Then it turns them over for the next operation. Versatile! Practical, too—because it eliminates the need of a press for piercing and a separate turnover unit. Typical of the Danly engineering that applies hydraulics and imagination to speed production and cut costs.

Danly's complete line of Hydraulic Platen Presses and hydraulic cylinders offers you the tools to solve virtually any compression molding, bonding, laminating, trimming, extruding or piercing problem in processing metal, plastics, or rubber. They're precision units with accurately machined platen faces, positive parallel platen closure, uniform pressure distribution and extra, rigid strength. And Danly's versatile engineering adapts these tools to *your specific needs.*

DANLY®

HYDRAULIC PRESS CATALOG shows all the features, sizes, adaptations—all the reasons why you should invest in a Danly. Write for your copy.



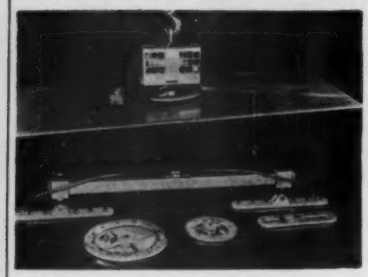
Mechanical Presses, Die Sets, Diemakers' Supplies, Hydraulic Metalworking Equipment

DANLY

DANLY MACHINE SPECIALTIES, INC., 2100 South Laramie Ave., Chicago 50, Ill.

CIRCLE 352 READER SERVICE CARD ▲ CIRCLE 353 READER SERVICE CARD

NEW SHOP EQUIPMENT



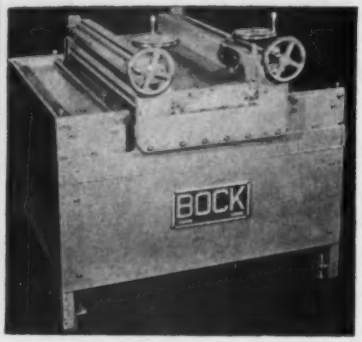
1-ton Vac-U-Lifter Handles Wide Range of Material Sizes

This Vac-U-Lifter weighs only 65 lb yet will lift material from a few ounces to 2000 lb. It will handle aluminum, glass, stainless, stone, wood, plastics, or any other relatively nonporous materials.

Unit with the basic Vac-U-Lifter Aluminum Powerpac features a quick-disconnect coupling for speedy attachment and detachment of beams or individual pads. Beam length can be specified. Vacuum pads can be adjusted up and down the beam for handling various material sizes, or oval pads may be swiveled for handling narrow or wide materials. Wide variety of pads can be used. Vacuum power source is self-contained and can be used as a separate unit for vacuum chucking.

Vac-U-Lift Co, Salem, Ill

MORE DATA? Circle 106, inside back cover

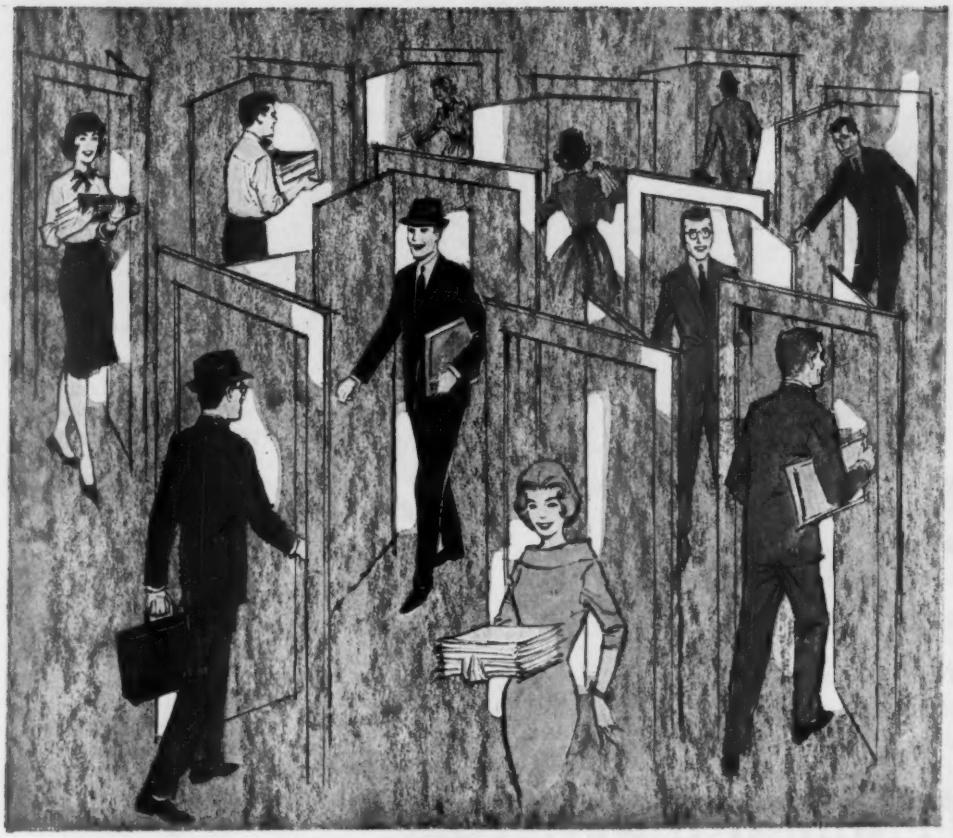


Roller Leveler Handles Steel up to 48 in. Wide

Leveler for handling uncoiled steel in widths up to 48 in. and thicknesses up to 16 gage has a total of 11 rolls, 7 for straightening, 4 pinch. Maximum speed is 60 fpm and unit is driven by a 1-hp electric 110/120-v gear head motor. All moving parts are guard-covered and needle bearings are used throughout. Electric magnetic clutch is optional.

Elkhart Welding & Boiler Works Inc, 2132 S Main St, Elkhart, Ind

MORE DATA? Circle 107, inside back cover



Open Sesame

Tens of thousands of doors of every description, in many of the most distinguished homes, commercial and office buildings, are equipped with the famous hinges produced by The Stanley Works, New Britain, Conn. In fact, because they provide advanced styling and long-lasting beauty to what had always been considered "stock hardware", Stanley hinges are specified by knowledgeable architects and industrial designers the world over. The name Stanley has become a byword wherever hardware users want more than function alone.

STANLEY ADDS BEAUTY AND STYLE TO PROSAIC HARDWARE WITH THE HELP OF TEN-YEAR OLD MEAKER AUTOMATIC PLATER

To most people, a hinge is a piece of hardware on which doors or piano tops swing open and closed. Today's architects and industrial designers go beyond function alone when specifying hinges, however, for they must complement modern materials and sleek design elements.

With the help of a MEAKER AUTOMATIC PLATING MACHINE, Stanley Hardware Division produces a family of hinges with advanced styling and life-time attractive finishes, specified for distinguished buildings the world over.

According to Stanley management, their MEAKER "AUTOMATIC" has also helped expand markets by providing a variety of durable finishes unmatched by competitive manufacturers. Typical, is a new forged bronze paumelle hinge for flush interior doors, finished in beautiful satin chrome, to complement interior decor.

What's more, absolute minimum down time has been recorded since the MEAKER "AUTOMATIC" was installed *over ten years ago*. During this time, Stanley has also processed literally tons of chrome or nickel finished products of their hardware division, on their MEAKER.

To expand markets by getting the jump on competition, more and more progressive manufacturers are turning to MEAKER AUTOMATION ENGINEERS. Our catalog, WHEN TO AUTOMATE, gives valuable pointers for improving profits through automatic plating or metal finishing.

THE MEAKER COMPANY

SUBSIDIARY OF SEL-REX CORPORATION

Nutley 10, New Jersey

Factories and offices Chicago 50, Ill., Los Angeles, Cal. and Nutley 10, N. J.

More completely finished parts at the end of the day with no partly finished pieces lying around is the regular accomplishment of Goss & DeLeeuw "1-2-3" chuckers. It means complete finishing on one, two or three ends simultaneously or in sequence without tool resetting, rechucking or parts handling. Machining operations may include boring, facing, turning and threading.

Change over from job to job is simple. Cost-cutting is assured on long or short runs. Goss and DeLeeuw Chucking Machines are the only standard machines of their type which operate the "1-2-3" way to reduce costs per piece and step up the number of pieces per hour.

Investigate the opportunities offered by these machines on your production by sending samples of your work for time and cost estimates—Ask for illustrated descriptive literature.

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

Portable Arc Welder Weighs Only 45 lb, Delivers 125 Amperes

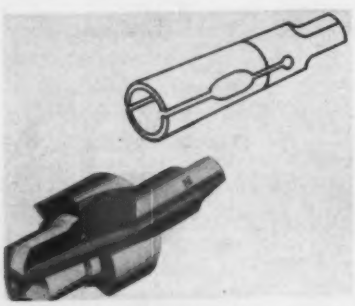
Portable arc welder that weighs only 45 lb delivers a full 125 amperes. It will weld anything from light sheet metal to ½-in. plate without special electrodes. Welding range is from 25 to 125 amperes in 12 heat stages. The unit operates from any 115 to 230 volt AC line with 75 volts open circuit for easy arc starting, and will operate with either carbon arc or metallic process.

The welder, which has a fan-cooled transoidal transformer to keep its heavy windings ventilated is housed in a one-piece molded glass fiber case that is rust and dent proof. Use of the plastic case eliminates electrical losses that might result with a metal case.

Price of the welder, complete and ready to weld with all accessories including cables, electrode holder, welding helmet, and a supply of electrodes, is $125, FOB Brooklyn, NY.

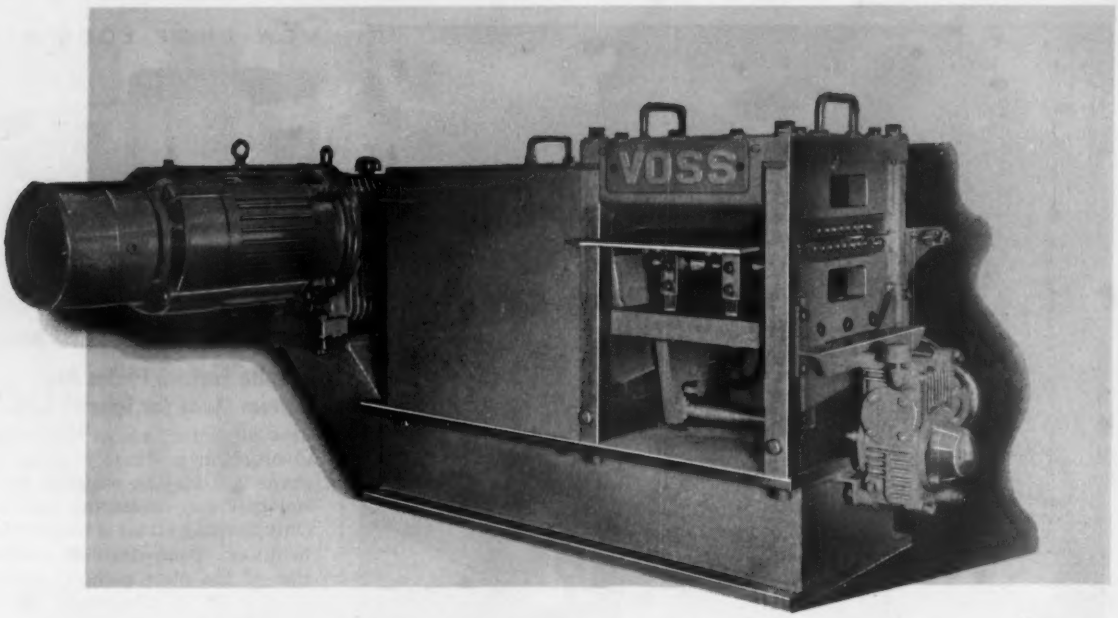
Bren Weld Sales, Inc, 5114 Third Ave, Brooklyn, NY

MORE DATA? Circle 108, inside back cover



STANDARD PORT CONTOUR CUTTERS incorporate a tang drive and are easily adapted directly to the machine spindel by using a standard drill driver. This method of driving reduces possibility of run-out because of inaccurate alignment and provides an economical way of adapting the cutter to most standard machine spindles without intermediate assemblies. All sizes of cutters available from stock have ground form-relieved flutes. — *Metal Cutting Tools, 301 South Water St, Rockford, Ill*

MORE DATA? Circle 109, inside back cover



HERE'S THE MACHINE THAT'S REVOLUTIONIZING STAMPED PARTS-FLATTENING*

DEAD FLAT—FAST! That's what the Voss stamped parts-flattener does. As fast as it's fed, it achieves within .005 of dead flatness—*in one pass*. Eliminates hand flattening on an enormous variety of stamped parts. Can even be engineered to flatten parts having irregular surfaces.

COMPACT: Most models are compact enough to sit on a desk top. Yet the flattener inherits the ruggedness of the famed Voss Precision Roller Leveler.

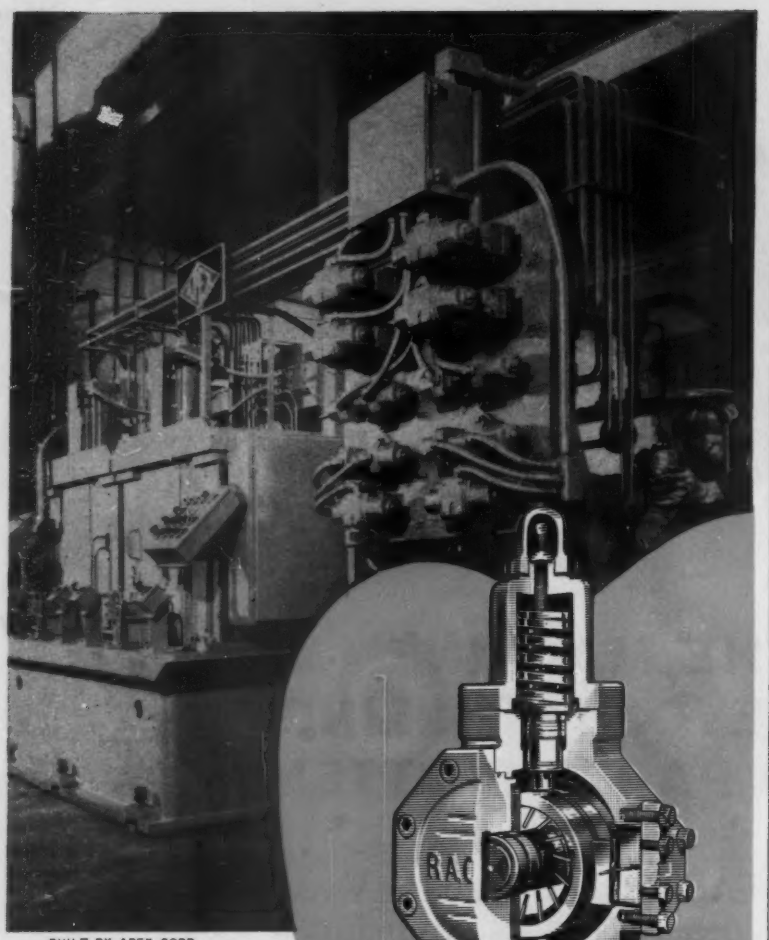
* One major user reports that 2 Voss parts-flatteners and a few operators have replaced 300 workers engaged in hand flattening operations.

We'll be glad to arrange a demonstration with your parts, without obligation.

Voss ENGINEERING CO.

7301 Penn Ave. Pittsburgh 8, Pa. Churchill 2-4422

(Makers of the Voss Precision Roller Leveler)



BUILT BY APEX CORP., ROSEVILLE, MICHIGAN

This active hydraulic heart helps

SEAL POROSITY IN 106 TRANSMISSION CASES EVERY HOUR

A RACINE VARIABLE VOLUME PUMP and 10 RACINE VALVES control *all* mechanical operations in this Apex impregnating machine, which seals leaky transmission cases at a major auto firm's transmission plant in Toledo, Ohio. Apex specified RACINE equipment because its design simplifies machine design problems . . . eliminates the need for extra pumps and valves. RACINE PUMPS are easy-to-control . . . handle pressure compensation *automatically* for varying gpm requirements. Apex has *preferred* RACINE for over 10 years!

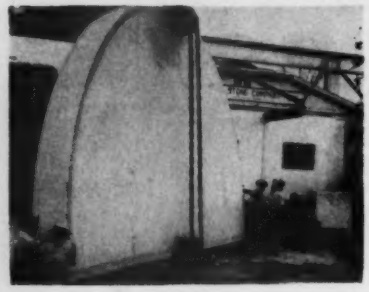
the HEART of this impregnating machine is a RACINE MODEL 6FA PUMP

RACINE

Racine Hydraulics & Machinery, Inc.

RACINE, WISCONSIN

HYDRAULICS DIVISION



Granite Surface Plates Are Custom-Made for Special Jobs

Line of surface plates can be made to order in practically any size or shape that may be required for special precision measuring operations. Only limiting factor is transportation facilities. Semi-circular configuration of the plate pictured measures 25 ft long, 15 ft wide, 20 in. thick; weight is 94,000 lb.

The larger size plates are available in Mt Airy gray granite. Plates up to approximately 16 ft long are also available in Balfour, Arabian, and Crystal pink granites. All are true quartz containing approximately 25 to 30% quartz to assure dimensional stability.

Herman Stone Co, 1860 N Gettysburg Ave, Dayton 27, Ohio

MORE DATA? Circle 110, inside back cover

Nutrunners and Screwdrivers Have Torque Control Clutch

Two models equipped with a torque control clutch have been added to the 41F series of air-powered tools. Clutch is adjustable for any desired torque from 5 to 100 in.-lb. Clutch jaws automatically disengage when a pre-set torque is reached and as soon as the tool is released from the work the clutch automatically sets itself for the next fastener.

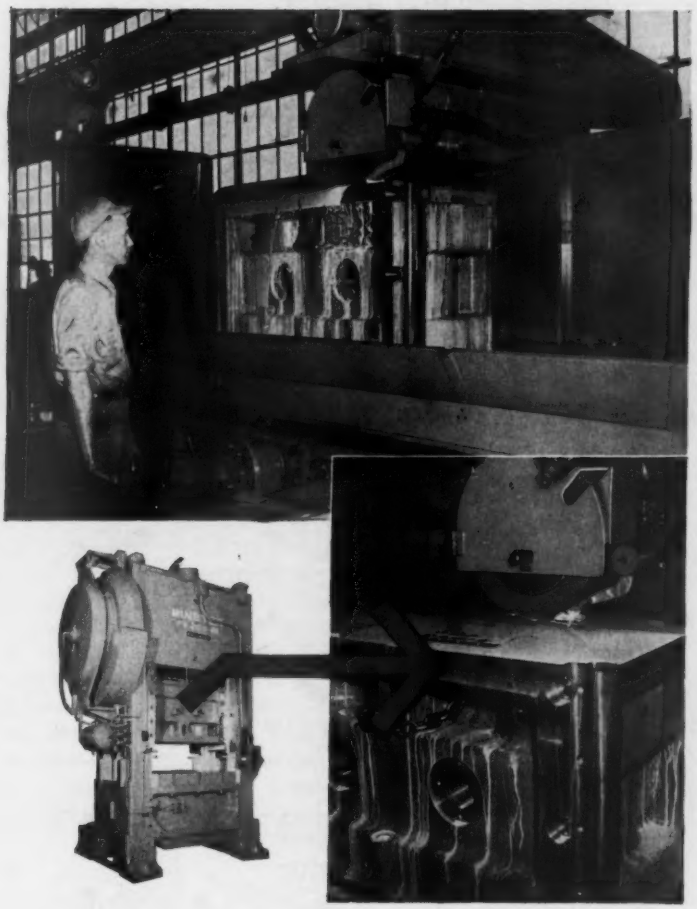
The nutrunner model, 41F-174, has a ⅜-in. square drive front end; as a screwdriver, 41F-134, the tool has a ¼-in. female hex spindle. Air motor drives the clutch at a free speed of 1500 rpm. Weighing less than 5 lb, these tools have an overall length of 10-13/16 in. Drive offset is 1 in.

Buckeye Tools Corp, 5003 Springboro Pike, Dayton 1, Ohio

MORE DATA? Circle 111, inside back cover

SIZE FOR SIZE

there are no heavier or more accurate surface grinders made than these fast heavy duty Thompsons



Thompson Type CX heavy-duty surface grinders are designed to grind heavy, massive work pieces. Their stock removal rate is very fast while maintaining extremely close limits of accuracy and microfinish.

Shown here is a Thompson Type CX 30x36x96 machine recently installed in the Minster Machine Company plant at Minster, Ohio. It is grinding the face of the slide for a 200-ton capacity Minster Piece-Maker High Speed Automatic Production press.

The slide is cast iron and weighs approximately 7000 pounds. It is being ground for precise parallelism and to a 20 to 30 RMS finish.

Thompson Grinders have an important part in the production of these world-famous Minster presses. The dependability of Thompson Service and the excellent performance of the Thompson machines now in use at Minster were major factors in the purchase of this latest grinder.

If your production involves the grinding of large, heavy work, it will pay you well to investigate the money and timesaving features of these modern machines.

THE THOMPSON GRINDER CO. Springfield, Ohio

Thompson SURFACE GRINDERS

"Keep Thompson in mind for that daily grind"

Coolant Sump Cleaner Handles up to 20 gpm

Pumping rate for removing coolant, chips, and sludge from machine tool sumps has been increased 30% in the redesigned CeCor DLO. From 10 to 20 gallons of coolant, chips, and mud can be removed per minute. Ultra high suction (275 inches water) makes it possible to thoroughly remove slurried coolant mud and chips.

Pumping equipment is mounted on a self-sealing lid which fits standard 55-gal drums. Unit operates on 110-v 60c single-phase electrical circuits, with automatic overfill control, vacuum relief valve, 10-ft neoprene suction holes and nozzle.

Coolant Equipment Corp, Verona, Wis

MORE DATA? Circle 112, inside back cover

Static Machine Controls Are Programmed With Taper Pins

New all-transistorized machine controls—which control air cylinders, hydraulic cylinders, magnetic clutches, and brakes—are designed for use on machines which assemble, stake, press, weld, and otherwise fabricate or assemble parts. Heart of the static system is the transistor, which is used as a switch.

Basic functions are combined on printed circuit boards. Then, up to 20 assorted boards can be placed on one rack and programmed with taper pin connections. This design permits board insertion and system wiring on front side exclusively.

The logic boards and power supply are designed to operate at up to 160F with an input line voltage fluctuation between 100 and 130 volts.

Delco Radio Div, General Motors Corp, Kokomo, Ind

MORE DATA? Circle 113, inside back cover

ELLIPTIC SKIRTS AND ROUND RING LANDS are turned at the same time with this single-end Model 751 precision boring machine. The machine has two spindles and special drum-cams and tooling. In operation cam-controlled tools turn the elliptic skirt while rigidly mounted tools turn the ring land diameter. Two pistons are finished at one time to tolerances, on the ring land diameter of 0.001 in., and 0.0003 in. TIR on the elliptic skirts—*Ex-cell-o Corp, 1200 Oakman Blvd, Detroit 32, Mich*

MORE DATA? Circle 114, inside back cover

ASARCON

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Rockford Tool & Transmission Co.
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Waukegan
Bearing Headquarters Co.
Div., Ray M. Ring Co., Inc.
MA 3-5212
INDIANA
East Chicago
Bearing Headquarters Co.
Div., Ray M. Ring Co., Inc.
E. CHICAGO EX 7-3020
SAGINAW 1-8660
Indianapolis
Jones & Laughlin Warehouse Div.
Jones & Laughlin Steel Corp.
MELROSE 1-8311
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Powell Tool Supply, Inc.
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Williams & Co., Inc.
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LOUISIANA
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AUDUBON 1381
Shreveport
Standard Brass & Mfg. Co.
UN 5-4241
MARYLAND
Baltimore
Bronze Specialties, Inc.
LEXINGTON 9-1906
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MICHIGAN
Detroit
Copper & Brass Sales, Inc.
FOREST 6-6200
Meier Brass & Aluminum Co.
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Copper & Brass Sales, Inc.
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Kalamazoo
Bard Tool and Equipment Co.
FIRESIDE 3-2691
Lansing
Superior Brass & Aluminum Co.
IV 2-2754
Muskegon
Towne Hardware & Supply Co.
2-2651
MINNESOTA
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Associated Bearings Co.
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Carlstadt
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(New York LA 4-9546)
Newark
Federal Bronze Products, Inc.
MARKET 2-6330
Perth Amboy
Gregg's Brass Foundry
HILLCREST 2-2086
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STerling 8-1144
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HAMILTON 6-1630
Syracuse
Meloon Bronze Foundry, Inc.
GLENVIEW 4-3231
Troy
The Troy Belting & Supply Co., Inc.
AS 2-4920 (in Albany 3-6121)
OHIO
Akron
Akron Welding and Spring Co.
JEFFERSON 5-2187
Cleveland
Copper & Brass Sales, Inc.
VU 3-8100
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MICHIGAN 1-6520
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PENNSYLVANIA
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Milwaukee
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CIRCLE 359 READER SERVICE CARD

ASARCON

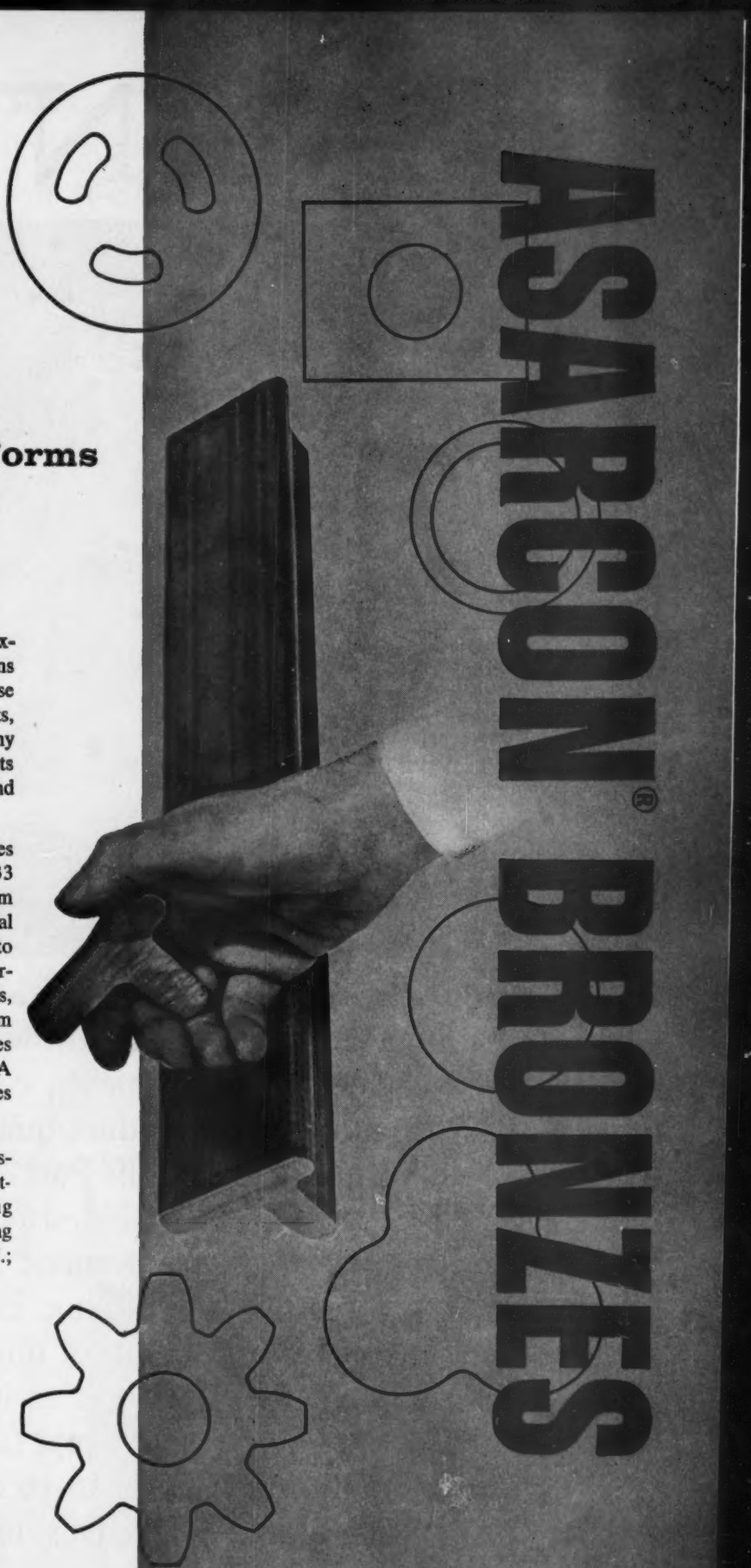
custom shapes and forms in any lengths you need

Asarcon continuous castings give you an extremely wide variety of shapes and forms in standard bronze alloys. They will increase your production rates and lower your costs, because: you get the shape you want in any length you need up to 20 feet. This permits machining on automatic screw machines and other high-speed equipment.

Continuous casting of Asarcon bronzes raises fatigue characteristics of standard alloys 33 to 100%, increases impact strength from 15% to more than double that of identical alloys cast other ways, adds materially to tensile, yield strengths and hardness. Asarcon 773 (SAE 660) bearing bronze in solids, rods and tubes is immediately available from stock in your choice of more than 260 sizes up to 9″ O.D. and lengths up to 105″. A wide variety of other special alloys, shapes and sizes produced to order.

For complete data on Asarcon continuous-cast bronze, write Continuous-Cast Department, American Smelting and Refining Company, Perth Amboy, N. J.; Whiting Ind., or 120 Broadway, New York 5, N. Y.; or call your nearby Asarcon distributor.

ASARCO



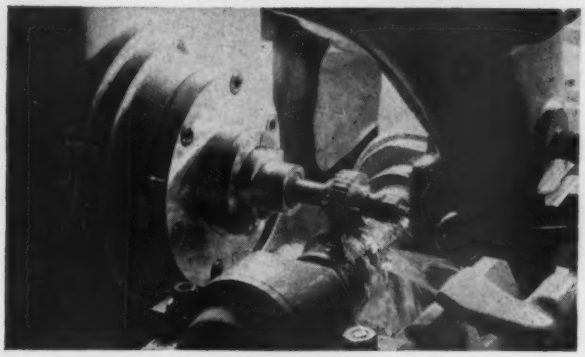
CIRCLE 360 READER SERVICE CARD

$24,000 ANNUAL

TOTAL JOB ANALYSIS *multiplies savings over conventional cost studies*

Charles Bruning Company, well-known maker of copying machines and engineering instruments, can now put an additional $2,000 per month into product quality without charging their customers an extra nickel! Part of the reason is the MULTICYCLE version of the No. 16-16 hobbing machine. The machine is so simple and automatic that the operator has time to check his own work. Bruning, in effect, gets 100% inspection free. Savings are the result of objective analysis of the total job, and total cost. The hob is as important to the outcome as the machine. The 16 D.P. gear (shown) measures only 1.875" on the OD. But on the No. 16-16 it can be hobbed with a 3 1/2" diam. triple-thread hob. This increases index speed.

Speed is only part of the cost determination. Lowest total cost was Bruning's objective. Reduction of hob approach distance and noncutting time was their answer. Power vertical feed . . . rapid traverse of the workslide and hob carriage . . . and automatic control are three ways to minimize total cycle time. This is the MULTICYCLE concept. Result is conclusive. The right hobs and a modern machine are producing an annual net return of $24,000. ■ Are your costs pegged high by tradition? A new MULTICYCLE machine often pays for itself as a straight replacement. Choice of three preselect automatic cycles gives you complete general-

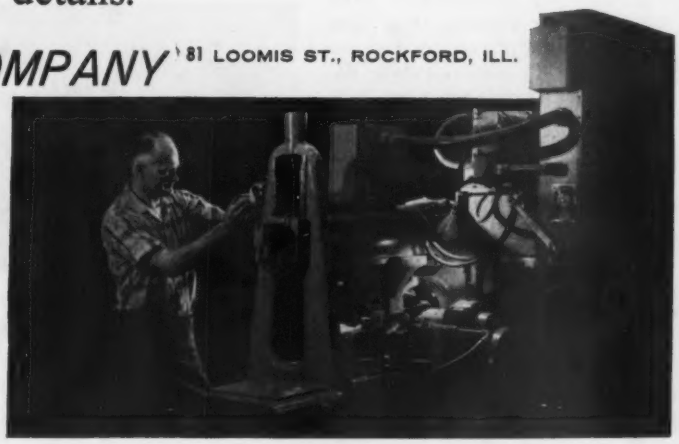


SAVING

purpose flexibility. Both setup and cycle time are reduced. ■ Take advantage of a Barber-Colman total job analysis. A complete cost evaluation . . . developed from your gear prints and production requirements . . . can be backed by a job simulation for your inspection in our TEST CENTER. Phone your Barber-Colman representative for details.

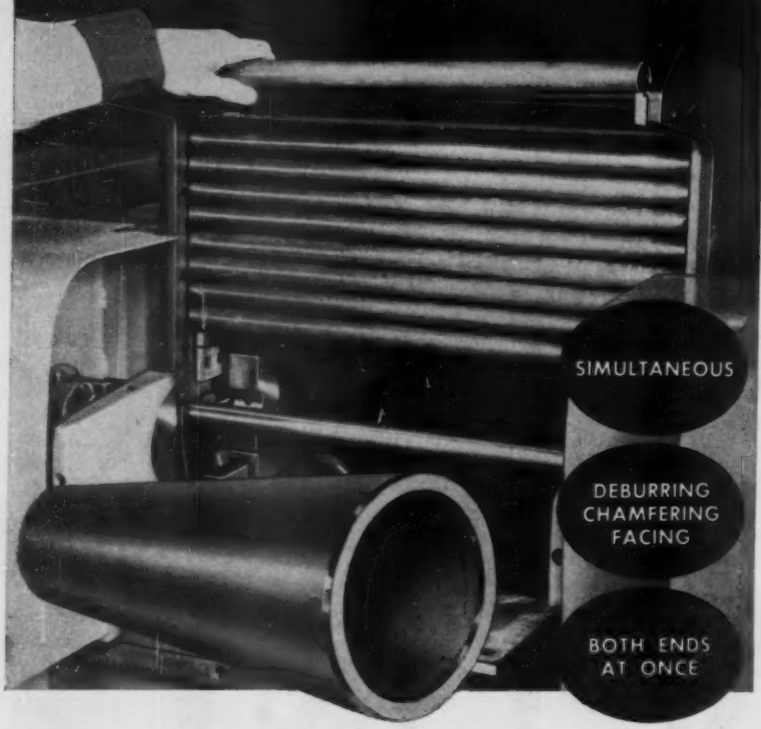
BARBER-COLMAN COMPANY 81 LOOMIS ST., ROCKFORD, ILL.

BARBER COLMAN



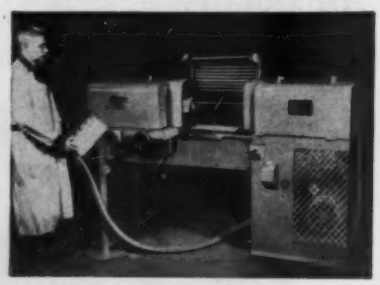
Operator checks his own work while the machine is cutting. Side benefit is free 100% inspection.

ANNOUNCING NEW PINES DOUBLE-END FINISHING MACHINE



HIGH PRODUCTION • ACCURACY • FLEXIBILITY

Filling the need for high production speeds and low unit costs, the new Model 666 Double-End Finishing Machine produces up to 1500 finished pieces an hour, holding length tolerances within .005". This new standard machine performs simultaneous inside-outside deburring, chamfering and facing, or light forming operations on both ends of tube, pipe, or rod. Workpieces are handled in diameters from ½" minimum to 3" maximum in lengths up to 60" on the standard bed machine, up to 120" on the extended bed machine. Operation is completely automatic with workpieces fed into machining position by the hydraulically operated Chute-Matic feed. Setup is fast with precision control of each machine function, easy adjustment to specific work length, and quick-change tool holders. Tooling is inexpensive with throw-away carbide bits. Special tooling arrangements are available to accommodate dedimpling. Find out now how this machine can help you produce parts faster, and at less cost.



WRITE TODAY FOR COMPLETE INFORMATION.

PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

678 WALNUT • AURORA, ILLINOIS

PRODUCTION BENDING • DEBURRING • CHAMFER MACHINERY

NEW SHOP EQUIPMENT

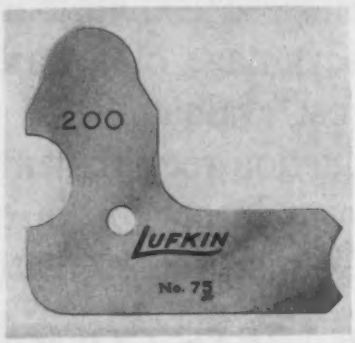
Torque Screwdriver Offers Inch Ounce Range

Hunter-Torque Controls of Santa Fe Springs, Calif, has developed an inch ounce torque screwdriver available in two models.

The adjustable model, TS-100, has a torque range from 4 to 100 in. oz. Adjustment is made by setting a micrometer dial located in the neck of the tool. Tool contains a ¼-in. square male drive, is 6½ in. overall, weighs 8 oz. The fixed setting model, TS-SN1, has torque range from 1 to 100 in. oz, is 5 in. overall, weighs 6½ oz.

R N Hunter Sales Co, 9851 Alburtus Ave, Santa Fe Springs, Calif

MORE DATA? Circle 115, inside back cover

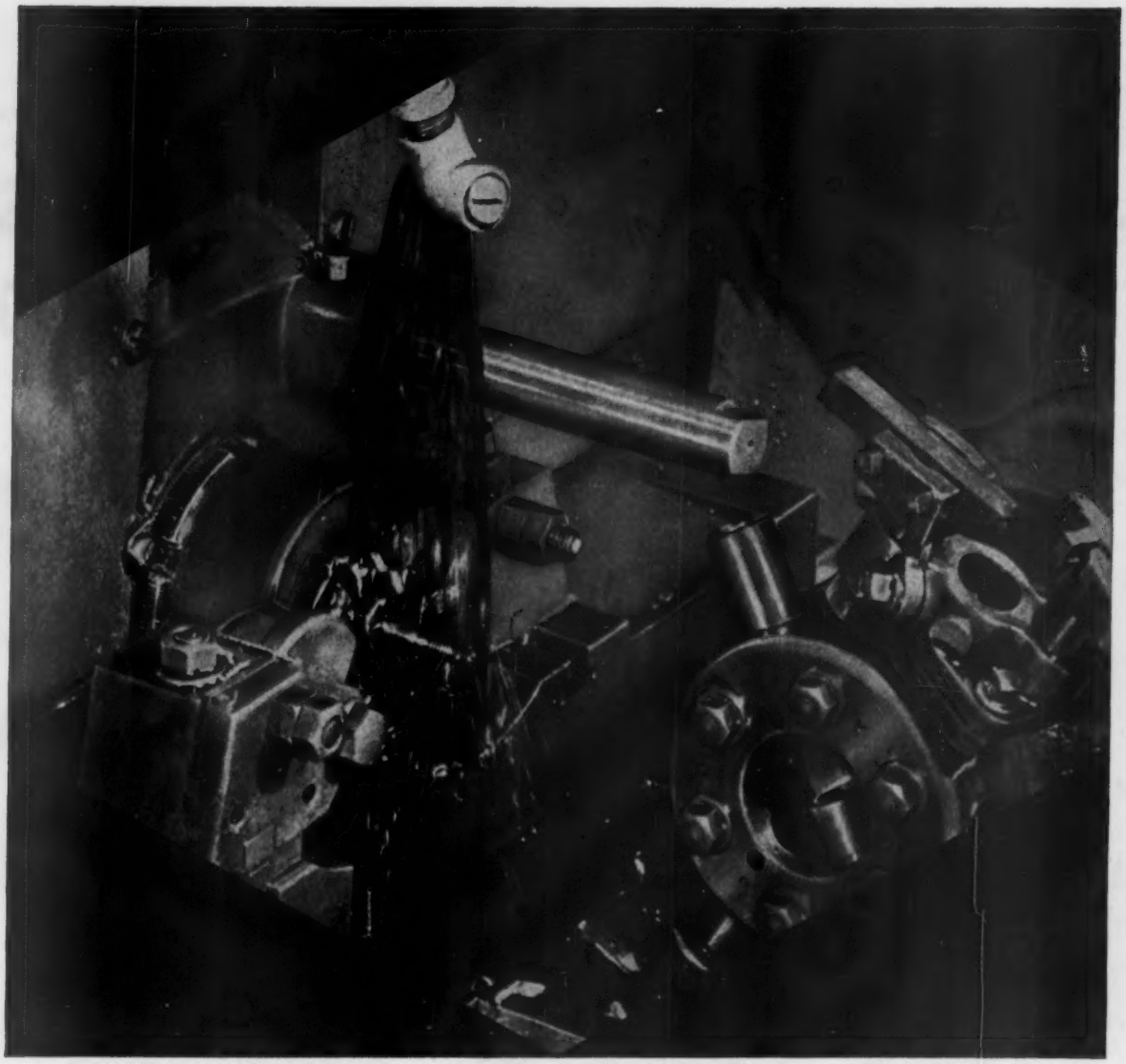


Stainless Hardened Radius Gages Offered in Fractional or Decimal

Line of stainless, hardened radius or fillet gages includes 33 for fractional radii, ranging from 1/64 to 1 in., and 36 for decimal radii, ranging from 0.010 to 1.000 in. There are also seven sets of gages in the S77 series (fractional) radius gages and seven sets in the 75 series (decimal). Sets are packaged in vinyl folding cases with individual transparent pockets.

Lufkin Rule Co., Saginaw, Mich

MORE DATA? Circle 116, inside back cover



Replace those black, sulfurized oils! Get cooling, cutting properties you need in a transparent Sunicut cutting oil that lets operators *see* tools, workpieces, finishes and micrometer readings. Sunoco has a wide range of high quality, non-emulsifying Sunicut cutting oils for general-purpose or special-problem operations. They pump easily, wet metal fast, have high film strength, will not stain operators' hands or clothing.

You'll see more than just the job...with Sunicut

SUNOCO

QUALITY...

THE BEST ECONOMY OF ALL

You'll see significant savings, too, when you switch to a transparent Sunicut cutting oil. For you will get the exact *quality* you need for your operation . . . *job-fitted* by men who know what they are doing . . . teamed with *service* you never have to ask for twice.

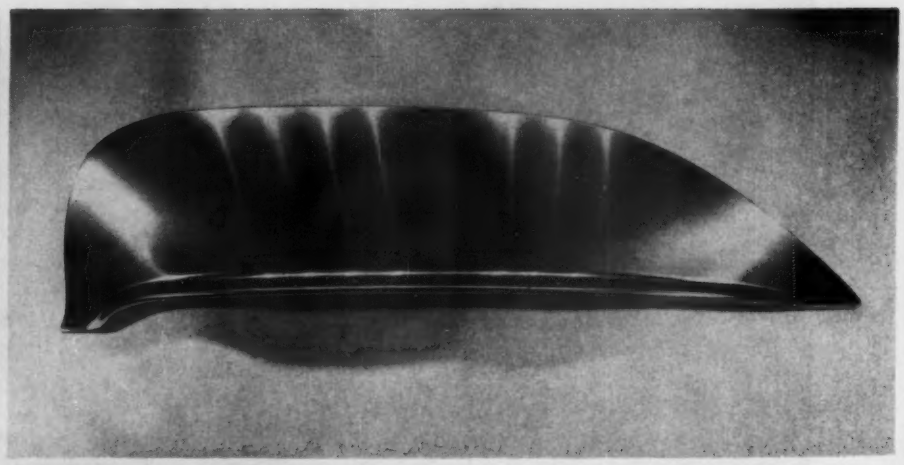
Let a Sunoco representative get you started with a Sunicut cutting oil now. The dividends in extra performance and savings will prove how right you were in investing in Sunoco quality.

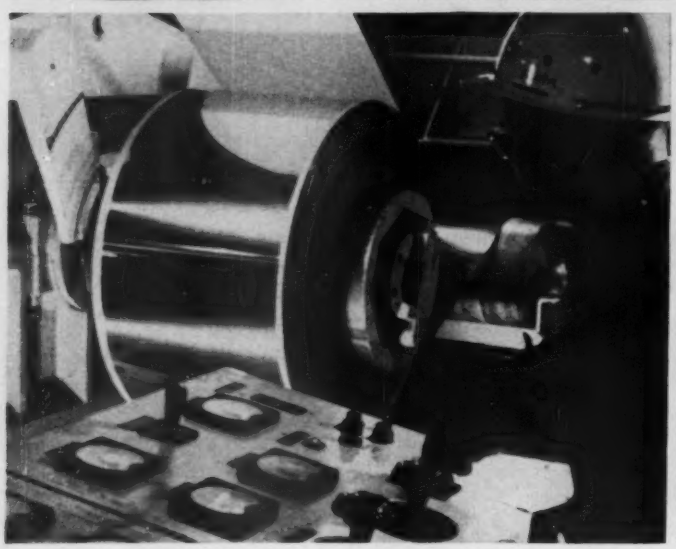
Sun Oil Company, Philadelphia 3, Pennsylvania, Department 8
In Canada: Sun Oil Company Limited, Toronto and Montreal.

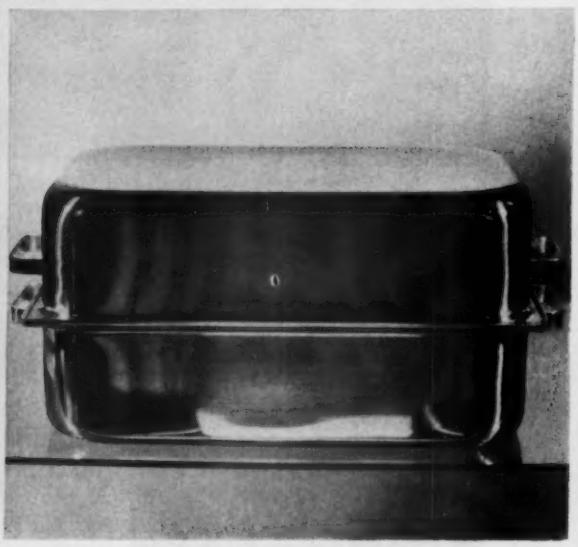
PIONEERING PETROLEUM PROGRESS FOR 75 YEARS

New steels are born at Armco

SLASH FINISHING COSTS ARMCO BRIGHT ANNEALED







For Beauty, Strength and Economy

WITH STAINLESS STEELS

Armco experience (since 1955) in producing stainless with this bright, smooth surface helps assure uniformity.

By using Armco Bright Annealed Stainless Steels you give your products the tough, durable beauty of stainless and eliminate or substantially reduce polishing or buffing operations. Lower finishing costs are assured because this smooth, high-luster surface is produced at the mill.

In many cases, parts made of Bright Annealed can be assembled without surface finishing. If parts are formed or drawn, some polishing or buffing may be necessary to fully restore the lustrous surface. Even where additional work must be done, it may be appreciably less than would be required for other types of stainless steel mill finishes. For example, one manufacturer of automobile trim was able to reduce his polishing and buffing operations from seven to only two by using Armco Bright Annealed Stainless Steel.

To enable you to take full advantage of cost-cutting possibilities, Armco produces Bright Annealed strip in all the regularly used chromium-nickel grades as well as Type 430.

For complete information, write us or contact your Distributor of Armco Stainless Steels. **Armco Division, Armco Steel Corporation, 2831 Curtis Street, Middletown, Ohio.**

ARMCO **Armco Division**

GET ARMCO STAINLESS STEELS FROM THESE STEEL SERVICE CENTERS

(A) Sheets, Strip and Plates (B) Bars and Wire

AMERICAN STEEL & ALUMINUM CORP. (AB)
Hartford, Conn.

AMERICAN STEEL & ALUMINUM CORP. OF MASS. (AB)
Cambridge, Mass.

BROWN-WALES COMPANY (AB)
Cambridge, Mass.—Auburn, Maine—Worcester, Mass.

CENTRAL STEEL & WIRE COMPANY (AB)
Chicago, Ill.—Cincinnati—Detroit—Milwaukee

CHICAGO STEEL SERVICE COMPANY (AB)
Chicago, Ill.

CLEVELAND TOOL & SUPPLY COMPANY (B)
Cleveland, Ohio

THE CONGDON AND CARPENTER COMPANY (AB)
Providence, R.I.—Fall River—Natick, Mass.

C. A. CROSTA, INC. (A)
Denver, Colo.

DUCOMMUN METALS & SUPPLY COMPANY (AB)
Los Angeles, Calif.—Berkeley—Phoenix—San Diego—Seattle

EDGCOMB STEEL & ALUMINUM CORP. (AB)
Hillside, N. J.

EDGCOMB STEEL COMPANY (AB)
Philadelphia, Pa.—Charlotte, N. C.—Greensboro, N. C.—York, Pa.

ESCO CORPORATION (AB)
Portland, Oregon—Denver—Emeryville, Calif.—Eugene, Oregon—Honolulu—Los Angeles—Seattle—Spokane—Vancouver, B. C.

PETER A. FRASSE & COMPANY, INC. (AB)
New York, N. Y.—Buffalo—Hartford—Lyndhurst, N. J.—Philadelphia—Syracuse

FIRTH BROWN STEELS LTD. (AB)
Montreal, P. Q.—Toronto

GATE CITY STEEL, INC.—OMAHA (AB)
Omaha—Columbus, Nebr.

INDUSTRIAL STAINLESS STEELS, INC. (B)
Cambridge, Mass.—Buffalo, N. Y.

EARLE M. JORGENSEN COMPANY (AB)
Los Angeles, Calif.—Dallas—Denver—Honolulu—Houston—Oakland—Phoenix—Seattle—Tulsa—Wichita

MAPES & SPROWL STEEL COMPANY (AB)
Union, N. J.

METAL GOODS CORPORATION (AB)
St. Louis, Mo.—Dallas—Denver—Houston—Memphis—New Orleans—N. Kansas City, Mo.—Tulsa—Wichita

MONCRIEF-LENOIR MFG. COMPANY (AB)
Houston, Texas—Dallas—Harlingen—Lubbock—San Antonio—Temple

MORRISON STEEL COMPANY (AB)
New Brunswick, N. J.

THE ORLEANS STEEL PRODUCTS COMPANY, INC. (A)
New Orleans, La.

WILLIAM M. ORR COMPANY, INC. (AB)
Pittsburgh, Pa.

PAPER-CALMENSON & COMPANY (A)
St. Paul, Minn.

SEABOARD STEEL & IRON CORP. (B)
Baltimore, Md.

SENECA STEEL SERVICE, INC. (AB)
Buffalo, N. Y.

SOUTHER STEEL & ALUMINUM COMPANY (A)
St. Louis, Mo.

J. M. TULL METAL & SUPPLY CO., INC. (AB)
Atlanta, Ga.—Birmingham—Greenville, S. C.—Jacksonville—Miami—Tampa

VIKING STEEL COMPANY (AB)
Cleveland, Ohio

VORYS BROTHERS, INC. (AB)
Columbus, Ohio

YORK CORRUGATING COMPANY (A)
York, Pa.—Washington, D. C.

IF you manufacture:

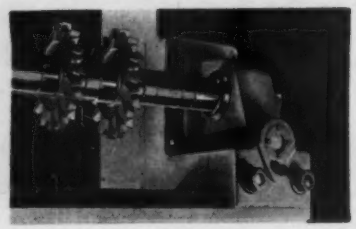
air conditioning
appliances
electronics
communications
electrical apparatus
fans
blowers
machine tools
materials handling
panelboards and switch boards
prime movers
pumps
compressors
general machinery

these Westinghouse products are tailored for you

On these pages are shown some of the many components developed and manufactured by Westinghouse specifically for OEMs. Here is one single source for technical assistance, manufacturing and stocking of all of your electrical needs. Use this *total* service to solve your design and manufacturing problems now. Call your local Westinghouse Sales Engineer or write Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*

J-96163-R

Westinghouse



Anti-Friction Support Bearing Claimed to Up Arbor Rigidity

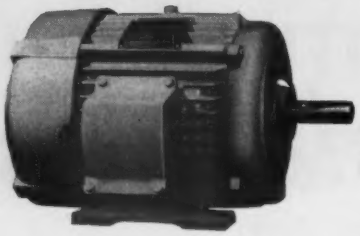
Anti-friction arbor support bearing is available in standard sizes to fit machine's support housing without re-boring. Bearings have a large number of balls, distributed evenly over the bearing race, that provide full-length support, minimize friction and increase arbor rigidity.

Simplification of design permits a price reduction of 25 to 30% on these bearings as compared to previous models. Design also eliminates stress and strain imposed on the bearing by lineal movement of arbor due to thermal changes. Reducing bushings are available for each size bearing so that a standard range of arbor diameters may be handled.

Briney Mfg Co, PO Box 208, Pontiac, Mich

MORE DATA? Circle 117, inside back cover

NEW



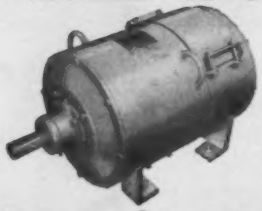
totally enclosed a-c motors

15% increased capacity, 80% to 100% longer life at rated loads. Totally enclosed motor with Class "B" insulation for greater performance life, lower maintenance under toughest conditions. Available as standard on 1 hp to 250 hp sizes in famous Life-Line "A" design. For information, write Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*

J-96182

Westinghouse

NEW

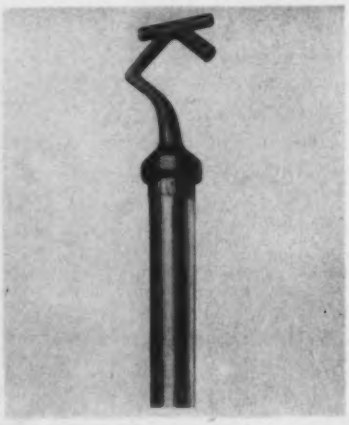


permanent magnet runout table motors

Improved performance, more torque per ampere, high temperature insulation. This watertight motor is designed specifically for starting, stopping, and reversing of rugged steel mill machinery and equipment. Epoxy insulation system provides full protection, highest resistance to corrosive agents and retains mechanical flexibility throughout its life. Write for Bulletin B-8247. Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*

J-96179

Westinghouse



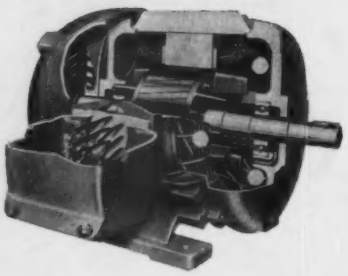
Plating Anode Designed for Use With High Flouride-ion Solutions

Heil HS-32 anodes are made of a new, special lead alloy developed specifically for use with high fluoride-ion plating solutions. They are reported to have superior current conduction properties after idle or shut-down periods. Anodes are available in four round diameter sizes and any desired length.

Heil Process Equipment Corp, 12850 Elmwood Ave, Cleveland 11, Ohio

MORE DATA? Circle 118, inside back cover

NEW



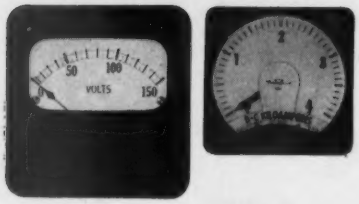
Guardistor motors

Eliminate production shut-downs from motor burnouts! Static thermistors in windings sense critical temperatures—take motor off line, flash warning signal. No nuisance tripping—no parts to wear out or fail. Available on all new Westinghouse motors; all types of rewound motors. Write for Bulletin B-7876-R. Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*

J-96180

Westinghouse

NEW



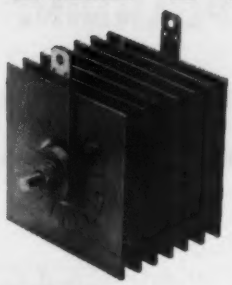
tbs* switchboard instruments

No friction, higher sensitivity, infallable repeatability, unaffected by shock or vibration (can be shipped installed in equipment). These new Westinghouse K-241 and K-251 Taut Band Suspension instruments available in 4½" full view 250° scale or 6" rectangular 100° scale designs. Meet or exceed ASA Standard C-39.1. For sample of TBS and Bulletins 43-240 and 43-250, write Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*

J-96181 *Trademark

Westinghouse

NEW



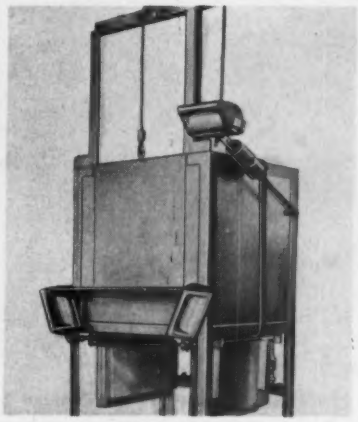
VOLTRAP* surge suppressor

Positive surge protection for silicon and germanium devices: Available in 16 ratings from 30 to 480 volts rms; clamping voltage range either 250% or 280% of rms voltage rating; 8 discharge ratings, 2 to 80 amps; polarized or non-polarized units. Write for TD 19-163. Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*

J-96184 *Trademark

Westinghouse

NEW SHOP EQUIPMENT



Shell Investment Mold Furnace Designed for Small Working Area

This gas-fired furnace for firing all shell investment casting molds operates at up to 1800 F. Vertical sliding front door is counterbalanced by a weight and cable-pulley mechanism. Whole mechanism is built close to the furnace side-wall to avoid protrusion of parts into adjacent working area; counterweighted drop-bottom trapdoors are hinged from the sides of the furnace to facilitate front opening and closing.

Firing chamber is 18 x 18 in. Floor space is 46 x 46 in.

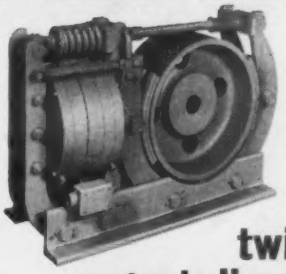
Alexander Saunders & Co, 95 Bedford St, New York City

MORE DATA? Circle 119, inside back cover

AUTOMATIC ASSEMBLY TOOL delivers independent staking and pressing forces that are adjustable from light taps to 1 ton. Standard interchangeable tooling adapts to variety of work and tools can be changed by the operator in less than one minute—*Cramer Controls Corp, Machine Tool Div, Centerbrook, Conn*

MORE DATA? Circle 120, inside back cover

NEW



twin magnet direct current brake

For all applications that require fast stopping of the motor and load. Available in six wheel sizes, 8" to 23", meets all AISE standard dimension requirements. Uses twin magnet epoxy encapsulated coils, has six integrated compact sub-assemblies and requires only two easy adjustments for shoe wear and spring tension. Write for B-8248. Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania. *You can be sure . . . if it's Westinghouse.*

J-96178

Westinghouse

NEW

economy K-221 tbs* switchboard instruments

Famous TBS features, plus new economy. Lowest priced high quality switchboard instrument available today. Taut Band Suspension K-221 instruments offer permanent accuracy and are unaffected by shock or vibration (even shocks caused by shipping installed in equipment). Meets or exceeds ASA Standard C-39.1. For TBS sample and Bulletin 43.220, write Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.* *Trademark

J-96183

Westinghouse

CIRCLE 369 READER SERVICE CARD

CIRCLE 370 READER SERVICE CARD

YOU ARE INVITED TO TAKE OUR FIVE-MINUTE COURSE IN COST REDUCTION PLANNING

R.S.V.P.
EMHART MFG. CO.
HUDSON DIVISION
HUDSON, N.Y.

EMHART

IN INVITING YOU TO TAKE OUR COURSE . . .

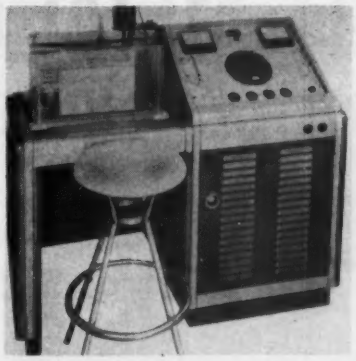
May we stress that, while we make precision V&O presses, feeds and automatic assembly machines, we are really in the business of helping you effect cost reductions in small parts production.

You can take our course by simply asking us to have the Emhart man in your area call on you. He is prepared to discuss cost reduction in the following areas . . .

1. PRODUCT DESIGN
2. MATERIAL AND PARTS FLOW
3. PACKAGING
4. FABRICATION
5. ASSEMBLY
6. DIRECT LABOR
7. INDIRECT LABOR
8. METHODS SIMPLIFICATION (People)
9. METHODS SIMPLIFICATION (Machines)
10. QUALITY CONTROL
11. IN-PROCESS INVENTORY
12. MAINTENANCE
13. FLOOR SPACE
14. SPARE PARTS INVENTORY (Customer)
15. SPARE PARTS INVENTORY (V & O Machines)
16. CRITICAL OPERATIONS

V & O
AUTOMATIC
PRESSES
AND FEEDS

CIRCLE 372 READER SERVICE CARD



Allen Aircraft Offers Compact Electroplating, Anodizing Unit

Improved Model 500 electroplating machine is a desk-sized unit that plates copper, nickel, chromium, zinc, cadmium and precious metals. It can also be used for hard-anodizing, sulfuric anodizing, electrochemical milling, electro-polishing and cleaning, and etching. Polarity changes for electroplating or anodizing at the flip of a switch.

Components of the Model 500 include: 7-gal plastic, lead or rubber-lined-steel tank-equipped with anode and cathode racks and immersion heater and agitators; a 20-amp rectifier that operates on 120 vdc and delivers up to 100 vdc; and a 1/3-ton refrigeration unit to keep solution temperatures at 15 to 65 F.

Allen Aircraft Products, Inc, Ravenna, Ohio

MORE DATA? Circle 121, inside back cover

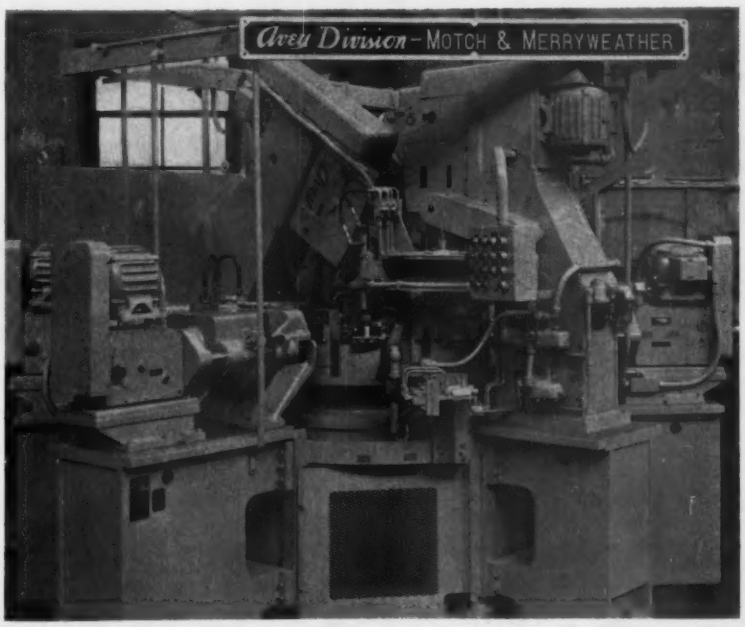
Air-Powered Wire Nips Designed for Production Jobs

Wire clippers called Air-Nips, designed for production wire trimming, are said to require 28 times less pressure to operate than conventional hand pliers. The 6-oz hand-sized clippers will cleanly cut soldered portions of 14-gage copper wire.

Pointed cutting head (replaceable) can be rotated 180°.

Chicago Pneumatic Tool Co, 6 East 44th St, New York 17, NY

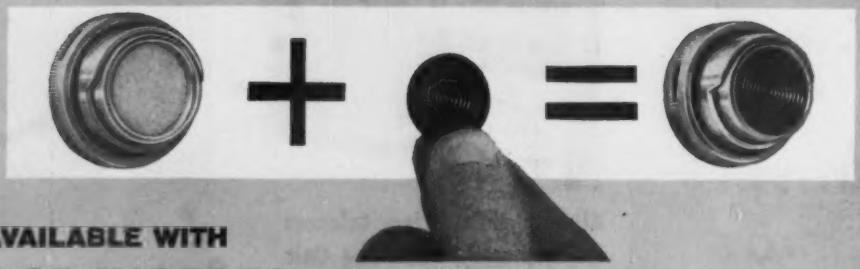
MORE DATA? Circle 122, inside back cover



ROTARY TABLE INDEXING MACHINE has six cam feed units mounted around it to machine an aluminum part for an automatic transmission. The table is 36 in. in diameter and has eight positions allowing the unit to turn out 150 parts per hour at 100% efficiency. Fixtures, which accommodate two work pieces, are arranged for automatic clamp and unclamp at the operators position—*The Avey Div, The Motch & Merryweather Machinery Co, Cincinnati 1, Ohio*

MORE DATA? Circle 123, inside back cover

Square D's ALL-METAL Push Buttons give EXTRA DURABILITY!



NOW AVAILABLE WITH

COLOR INSERTS—with these Important Advantages:

Longer lasting • Indestructible operator is made entirely of metal. High-density polyethylene inserts are permanently colored, won't fade or deteriorate on even the toughest jobs. Push buttons are completely oil-tight, even when depressed.

Reduce your inventory • Order push buttons in color desired, or get the new "universal" package containing a basic operator and seven different color inserts—no extra cost. Inserts just snap in, can be changed in seconds if necessary.

7 colors available • Choose from black, red, green, brown, yellow, orange, blue.

Complete flexibility • Any operator can be used with any contact block to meet every requirement. Contact block arrangements include single-pole double-throw, two-pole double-throw, four-pole double-throw, sequence closing, and overlapping contacts.

A COMPLETE LINE OF OIL-TIGHT OPERATORS

Write for Bulletin 9001-T. Square D Company, Dept. SA, 4041 No. Richards St., Milwaukee 12, Wis.

SQUARE D COMPANY

wherever electricity is distributed and controlled

Pines-Grieder Merger

Grieder Industries Inc, Bowling Green, Ohio, manufacturer of tube cutting machinery, has been merged into Pines Engineering Co, leading maker of production bending and end-finishing machines. Manufacture and sale of Grieder high-speed tube cutoff machines, automation equipment, and special machinery expands the Pines line of tube fabricating equipment. All executives and key operating personnel, as well as equipment, have been moved to Aurora, Ill (Pines headquarters), and operations are being discontinued at the Bowling Green plant.

Four standard cutoff machines, plus material handling and tube transfer machinery is being added to the Pines line of bending machines, bending presses, and tube end-finishing machines. The high production cutoff units range in capacity to a maximum of 4-in. diameter tubing with wall thicknesses to 0.250.

$50 Million Order to Hercules

Hercules Powder Co, Wilmington, Del, has been awarded a contract in excess of $50 million. Order, placed by the Air Force Systems Command, Ballistic Systems Division, is for continued research and development work on the third stage propulsion unit for the solid-propelled Minuteman ICBM.

Work under the new contract will be conducted at the Bacchus plant, Bacchus, Utah, with support provided by other Hercules plants in Rocky Hill, NJ, Kenvil, NJ, and at the company's Research Center near Wilmington.

Sunbeam Buys Furnace Firm

Mern Industries, Oconomowoc, Wis, manufacturer of heat treating furnaces and equipment, has been acquired by Sunbeam Equipment Corp, Meadville, Pa. The operation will be integrated with the Sunbeam line of furnaces at its manufacturing headquarters.

Chromalloy and Fansteel Sign Licensing Agreement

Chromalloy Corp, West Nyack, NY, and Fansteel Metallurgical Corp, North Chicago, Ill, have signed a licensing agreement giving Chromalloy the exclusive right to make use of inventions covered by several Fansteel patents. These pertain to the coating of refractory metals—molybdenum, tantalum, tungsten, and columbium—high temperature oxidation-resistance of which can be greatly improved by such metallurgical treatments.

"Chromalloy has successfully used the chromallizing process to protect steel, super-alloy, and refractory metal parts for a wide range of applications in the automotive, electrical heating, electron tube, jet engine, and missile industries," says company President Richard P Seelig. "The arrangement complements Chromalloy's own patent position in the field of refractory metal coatings."

Fansteel's primary interest is the production and application of reactive metals. Investigations which led to patents now licensed to Chromalloy were undertaken to show that reactive metals can be used at high temperatures in oxidizing atmospheres. The licensing arrangement is meant to expand research activities along these lines, particularly for electronics, aircraft, and missile work.

These two tape-controlled Burgmaster turret drillpresses make precision holes in nuclear reactor components at General Electric's Atomic Power Equipment Department (APED), San Jose, Calif. The automated machines, which incorporate a GE tape-control unit, can be programmed to perform automatically a continuing series of operations such as boring, milling, drilling, reaming, and tapping. The smaller unit was installed last summer; the larger machine, a recent acquisition, replaces three conventional drillpresses and their accessories. APED plans eventual automation of a major portion of its manufacturing facilities in San Jose and several other numerically controlled machines are now on order

$4.5 Million Order to Pullman

Gulf, Mobile & Ohio Railroad has placed an order for 475 freight cars with the Pullman-Standard Division of Pullman Inc. Contract means reopening of the nation's largest freight car plant at Bessemer, Ala, and recall of 1300 workers. Four-hundred box cars will be built at Bessemer and 75 hopper cars will be turned out at Pullman's plant at Butler, Pa.

Lockheed Renames Divisions

New name for the California Division is the Lockheed-California Co, headquartered in Burbank. The Georgia Division is now the Lockheed-Georgia Co, located in Marietta. Renaming is a further step toward uniformity in identification of the company's operating divisions, according to Lockheed President

vapor degreasing in Columbia-Southern Trichlor helps SWANK INC. set the quality pace, save on finishing costs

Natural topaz cuff link

Monogrammed tie clip and cuff link

Hand carved jade cuff link

Gleam of quality and appeal of unusual design characterize this selection of men's accessories from the Swank collection. Recent additions to the line include a full selection of small gift items and watches for men and women.

Attleboro, Massachusetts—Craftsmanship is a tradition in this New England jewelry center where Swank, Inc. produces its world-famous line of personal jewelry for men. Top quality in every price range demands care in manufacturing methods backed up with smart cost-control to keep them competitive. That's why vapor degreasing with such solvents as Columbia-Southern TRICHLOR was a natural to help Swank management meet the dual needs of effective cleaning at low cost.

Thousands of tiny parts made of all the decorative metals from brass and bronze to gold, silver, rhodium and others are buffed to a quality glow before final processing or protective plating. Since finish bespeaks quality in jewelry, no blemish-causing bits of soil could remain after the final cleaning step. The variety of metals to be processed, the tenacious buffing compounds to be removed without affecting the surface and the need for economy, gave the production department a real challenge.

Vapor degreasing was Swank's answer to the challenge. Taking advantage of modern equipment and the dependable quality of supplies like Columbia-Southern Trichlor with its heavy duty neutral stabilizing system, they were able to set up an efficient rate of continuous production without expensive shut down. Swank buys its Trichlor through Kraus Distributing Company of Providence, who also supplies other finishing materials.

A typical example of problem-solving teamwork between distributor and technical service from PPG's Chemical Division occurred recently which points up the value of well-informed suppliers. Swank was experiencing a mysterious build-up on the filters and distillation equipment which prevented proper operation of their large degreasing machine. A hurry-up call for help brought the distributor and the PPG representative. Sticking with the job until solved, they came up with the reason—an extra heavy load of insoluble spinning compound on parts being cleaned—and the solution, which involved adjusting the through-put rate and the method of work handling. Result: a return to production in a short time, with resultant savings.

Swank has found that Columbia-Southern Trichlor meets every test of quality and performance as a low-cost cleaning solvent in vapor degreasing. Trichlor is tailor-made for today's high production rates. It is produced under "Triple-check" quality control during manufacture for purity, uniformity and stability. This super-stabilized system helps protect your equipment from acid build-up. Finally, it is sold nationwide, through experienced distributors and backed up by qualified PPG Chemical Division technical service engineers. No wonder leaders like Swank of Attleboro look to Columbia-Southern Trichlor to keep them on target in efficiency and low cost.

For more details on vapor degreasing—the modern answer to metal cleaning—call your Trichlor distributor or our district office nearest you.

columbia | southern chemicals

CHEMICAL DIVISION

PITTSBURGH PLATE GLASS COMPANY

ONE GATEWAY CENTER PITTSBURGH 22, PENNSYLVANIA

DISTRICT OFFICES: Boston · Charlotte · Chicago · Cincinnati · Cleveland Dallas · Houston · Minneapolis · New Orleans · New York · Philadelphia Pittsburgh · San Francisco · St. Louis · IN CANADA: Standard Chemical Limited

Bill Lovenbury of Swank and Martin Kraus of Kraus Distributing Company, Trichlor distributors, inspect a rack of belt buckles which are clean, dry and ready for final plating. Swank designed many of its own work-handling racks and baskets to insure complete exposure to solvent.

Clear Trichlor flows past the sight glass after distillation, ready for more cleaning mileage. Swank has improved costs with many ingenious modifications of equipment, and increased awareness of solvent use by metering the solvent supplied to every department.

Mechanized vapor degreasing machine charged with Trichlor meets Swank's need for high production and economy. Combination of liquid spray and vapor rinse gives superior results in short time. Return conveyor system simplifies handling (one man loads and unloads) and reduces solvent loss.

NOW...
CONTINUOUSLY VARIABLE RANGE OF SPINDLE SPEEDS
WITH CONSTANT HORSEPOWER THROUGHOUT

Now, by simply pressing a button until the desired speed is indicated on the direct-reading tachometer, you can select any spindle speed from 43 to 3500 RPM.

The new Micro-Turn features exclusive Nebel coaxial headstock spindle design plus mechanical beltless type variator drive unit (5 HP), which delivers constant horsepower throughout the entire range and maintains drive output speed within two-tenths of one percent. This assures maximum torque at low speeds for heavy cutting and ultra fine finish at highest speeds, with supreme balance and minimum vibration. Built-in positive torque responsive mechanism prevents slippage under starting or shock loads.

Other features include:

- exclusive feed converter unit, located in apron, providing simple conversion from standard to optional feed ranges without affecting standard thread ranges;
- double-wall, one-piece totally enclosed apron;
- fail-safe pressure lubrication to headstock, gear box and end gearing;
- pressure lubrication to carriage and cross slide ways provided by pump located in apron; one-shot plunger to lubricate cross slide ways when carriage is stationary;
- choice of manual or automatic coolant operation.

For the complete, illustrated story on the revolutionary MICRO-TURN, write today for your copy of Bulletin No. 222. Nebel Machine Tool Corporation, Lathe Division, 3407 Central Parkway, Cincinnati 25, Ohio.

NEBEL
MICRO-TURN
HIGH SPEED PRECISION LATHE

CIRCLE 377 READER SERVICE CARD

Courtlandt S Gross. The Lockheed Missiles and Space Co was formed in June.

The L-C and the L-G companies will continue to operate as divisions of Lockheed Aircraft Corp. M Carl Haddon has been named president at California and W A Pulver president at Georgia. Both will continue as corporate vice presidents.

White Sewing Expands

Fibreglass Ohio Inc has been acquired by White Sewing Machine Corp, Cleveland, in a stock transaction. Production capabilities of the company will be combined with those of White's Apex Reinforced Fibre-Glass Division, a major producer of filament-wound pressure bottles and centrifugally molded tanks for military and commercial applications. Division also makes a diversified line of tanks, containers, and material handling units for automotive and industrial uses.

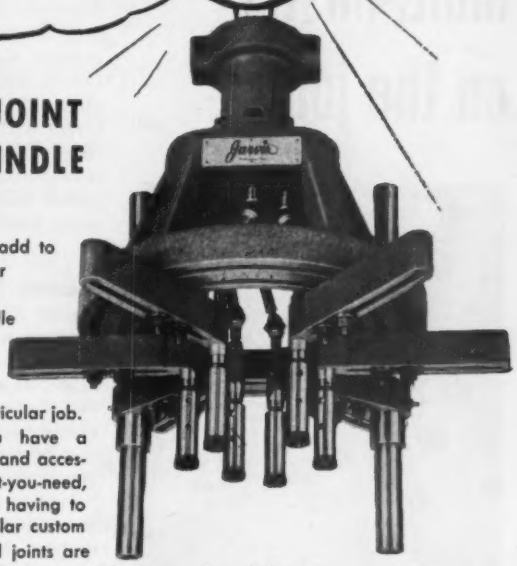
$10.5 Million Contract to Bendix

Army has awarded a prime contract to Bendix Corp for continued production of inertial guidance systems plus related equipment and services for the Pershing missile. Order, which will be carried out by the Eclipse-Pioneer Division, Teterboro, NJ, increases the company's total participation in the Pershing guidance system program to more than

"I think the boss wants to make me a partner. He said it's about time I took an interest in the business."

"NO OTHER HEAD OFFERS SUCH RANGE and VERSATILITY ON THE PRODUCTION LINE"*

JARVIS UNIVERSAL JOINT MULTIPLE SPINDLE HEADS



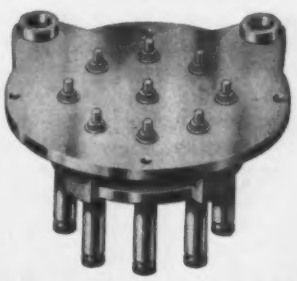
* For example, you can add to the basic head one or more of 20 optional accessories (such as Spindle Assemblies, Spindle Cluster Plate, Base Plate, Guide Rods, etc.) to meet the requirements of a particular job. With Jarvis Heads you have a greater selection of parts and accessories. A buy-only-what-you-need, custom-built head without having to pay the high cost of regular custom designed heads. Universal joints are of an advanced structural design which feature: low deflection rate; superior fatigue resistance; greater overload capacity and longer life. Joints have a snap-on feature and can be slipped off the spindle without use of tools.

EXCLUSIVE JARVIS FEATURES

Cut-away view (below) reveals high strength, light weight aluminum alloy castings, heavily ribbed for durability; gears and spindle drivers run in ball bearings, have more than thrust load capacities; idler gears mounted on heavy duty needle bearings running on specially heat treated steel studs; adjustable outrigger arms locked in position with threaded studs located in double "T" slots for positive positional settings.

NO NEED TO INVENTORY SEVERAL FIXED HEADS

Head converts easily to a fixed head by adding a Jarvis Spindle Cluster Plate (shown below) which can be jig bored, by you or by us, to locate spindles to suit hole spacing required. Cluster Plates will aid in reducing setup time and will assure correct setup each time.



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SEND TODAY FOR COMPLETE DETAILS

JARVIS CORPORATION,
26 Pease Ave., Middletown, Connecticut

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Company _____

Street _____

City & State _____

Tools stay sharp longer with Multi-Mister on the job

Forming and cutting tools last longer, stay sharper, produce better finishes when cooled and lubricated with DeVilbiss Multi-Mister. Adjustable for heavy or fine mist spray; swivel tip permits pinpoint aiming. Exclusive nozzle design provides instant spray for intermittent cycling. Get full details. Write: The DeVilbiss Company, Toledo 1, Ohio. Offices in principal cities.

FOR TOTAL SERVICE, CALL

DEVILBISS

$72 million. New award is the first expenditure for Pershing guidance systems under the Defense budget for fiscal 1962.

Hysol Acquires Permacel Line

Permacel Division of Johnson & Johnson, New Brunswick, NJ, has sold its epoxy electrical insulation potting and encapsulation product line to Hysol Corp, Olean, NY, producer of epoxy resins and coatings. Hysol will manufacture and market these materials and service Permacel's former customers. Both companies will continue to produce their other traditional product lines.

Reliance Electric Moves Division

Master Electric Division of Reliance Electric & Engineering Co, Dayton, Ohio, will move its operations to two new plants being built in Columbus and Madison, Ind. Move will be completed early next year and Columbus will be the headquarters for the division.

Master produces fractional horsepower and specialty motors and gearmotors. Motor production will be concentrated at the Madison plant and gearmotors will be turned out at Columbus.

Riehle Buys Two

Riehle Testing Machines Division of American Machine & Metals has expanded its line of testing machines, instruments, and accessories with the purchase of Steel City Testing Machines Inc of Detroit and the hardness tester business of Torsion Balance Co of Clifton, NJ, maker of Kentron and Kentrall hardness testers. Purchase gives Riehle a complete line of portable, bench, and floor-mounted hardness testers for Vickers, Rockwell, and Brinell hardness scales, and expands its line of tensile-compression, ductility, and flexure testing machines.

Avis Industrial Corp . . .

. . . Detroit, plans to set up a lock manufacturing plant at Greeneville, Tenn. Employment is expected to be about 400.

Mathews Conveyer Acquisition

Wilkie Co, Philadelphia manufacturer of telescopic roller, wheel, and belt conveyors, has been purchased by Mathews Conveyer Co of Ellwood City, Pa. The Wilkie units will be added to Mathews' line of gravity and power conveyers and special conveying machinery. The company will continue to operate in Philadelphia as a wholly owned subsidiary of Mathews.

Reynolds Expands in South

Reynolds Metals Co will spend $2.5 million on expansion of the cast house at its alloys plant in Sheffield, Ala. Enlargement will include installation of two holding furnaces with 80,000-lb capacity to be paired with two 100,000-lb melting furnaces with production rate triple that of the plant's present units.

NJ Firms Get Defense Orders

International Telephone & Telegraph Co, Paramus, has a $9.7 million Air Force contract to develop a Strategic Air Command control network.

RCA, Moorestown, has received a $6.7 million AF order for continued development of a ballistic missile early warning system.

Connors Steel Division . . .

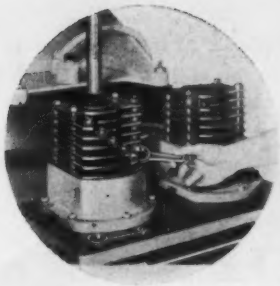
. . . of H K Porter Co has opened a reinforcing bar fabricating facility in New Orleans. Fabricating and surface handling equipment are now in operation at the site, with reinforcing bars to be supplied from the steel mills operated by Connors Steel Division.

Pratt & Whitney Division . . .

. . . of United Aircraft, East Hartford, Conn, has received a $64.9 million Navy contract for additional production of J-52 jet engines and a $5 million order for development testing of the engine. •

AM/MM

"Looks like the boss is about to kick off with another economy drive."



QUALITY FOR YOUR PRODUCTS STARTS HERE

What better way to guarantee high quality products than to hone them on precision BarnesdriL Honing Machines!

New from top to bottom . . . these machines incorporate every advanced feature gleaned from our 35 years of honing experience.

Greater ruggedness . . . a broader range of capacities . . . more compact design . . . easier maintenance — these are plus-features inherent in every BarnesdriL machine to give you precision control at cost-cutting production speeds.

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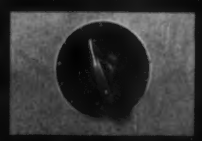
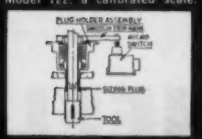


QUALITY is insured with correct hone feeds . . . made possible with this easy-to-set infinite hone feed control.

QUALITY at high-production rates means exact spindle speed rates . . . selected with a flick of the fingers.

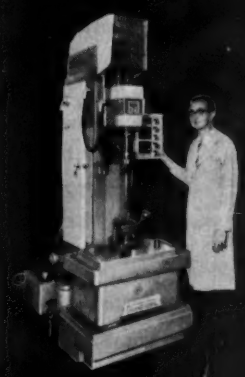
QUALITY results from correct reciprocation speeds . . . easily selected with this dial or, on the Model 122, a calibrated scale.

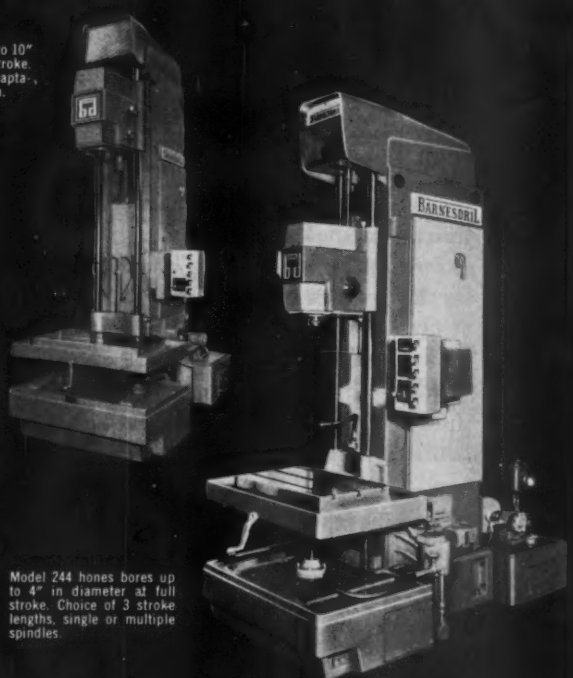


QUALITY is automatic with Plugmatic bore-to-bore sizing . . . production size consistency maintained to .0002".

Model 3010 hones up to 10" diameter at full stroke. Choice of 4 strokes. Adaptable for full automation.

Model 122 hones bores up to 2" in diameter at full stroke. Available in 1 or 2 spindles and a variety of fixtures and tables.





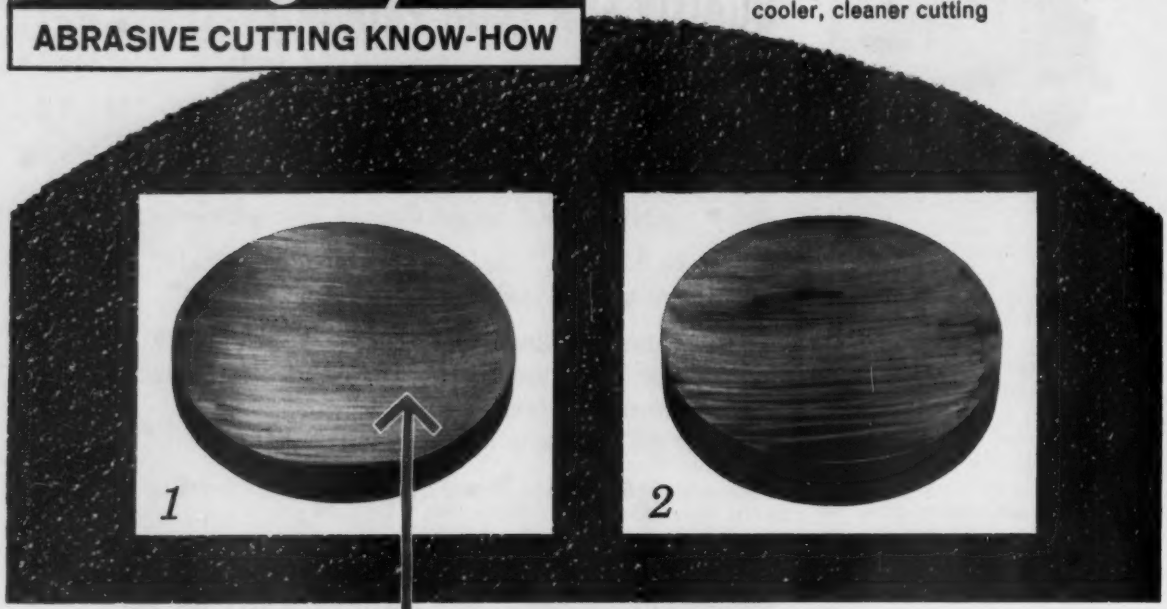
Model 244 hones bores up to 4" in diameter at full stroke. Choice of 3 stroke lengths, single or multiple spindles.

OUR FULLY EQUIPPED JOB HONING DEPARTMENT CAN HONE ANYTHING UP TO 25 FEET IN LENGTH. WRITE FOR DETAILS!

Allison-Campbell

ABRASIVE CUTTING KNOW-HOW

Close-up view of resinoid wheel shows rough texture that provides cooler, cleaner cutting

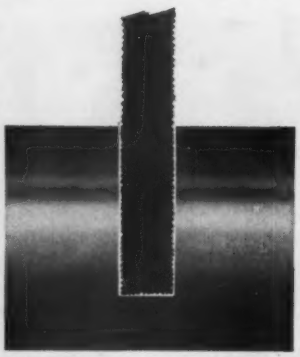


This CLEAN cut was made with a ROUGH-SIDED wheel!

1 • **THE SPECIMEN ON THE LEFT ABOVE** was cut from a 3¾" diameter hardened steel bar in just 28 seconds with an ALLISON *rough-sided* dry abrasive cutting wheel like the one shown in the background. Note that the cut is clean and practically burn-free.

2 • The specimen on the right was cut under the same conditions and with a wheel of the same formulation, but *without* rough sides. The result—the cut took 30 seconds and produced a badly burned surface.

3 • The secret is the extra clearance the rough sides give *inside* the cut (as shown in the small picture at right), and the resulting *cooler* cutting action. This adds to wheel life, too. That's why, for the dry abrasive cutting of solid bars, heavy-wall tubing and structural shapes, ALLISON-CAMPBELL field engineers generally recommend rough-sided wheels.



3 Inside the cut, rough-sided wheels give extra clearance, extra cooling for faster cutting and to prevent burning

For dry cutting of thin-wall tubing with minimum burr, a fine-grit, *smooth-sided* wheel is the choice. And for *wet* abrasive cutting, dozens of ALLISON wheel specifications are available to match the material you are cutting, the quality you require, and the cut-off machine you use.

Regardless of your cut-off problems, your ALLISON-CAMPBELL field engineer can help you choose the wheels that will give the results you want. He is an abrasive cutting specialist—use his know-how.

Write for **Bulletin DH-214A** *for details on the complete line of ALLISON wheels*

ACCO

ALLISON ABRASIVE CUTTING WHEELS

Allison-Campbell Division • American Chain & Cable Company, Inc.
923 Connecticut Avenue, Bridgeport 2, Conn.

HOW WORN THE DIE?

Save the high cost of excess grinding . . . measure with this New Bausch & Lomb Die-Wear Microscope

Every time you sharpen a die you pay for down time and grind away some of its useful life. But now B&L makes it easy to see whether the tool *needs* sharpening, and *exactly* how much metal must be removed to achieve the correct degree of sharpness.

The calibrated reticle of this ingenious new microscope gives you direct, easy-to-read measurement of die-wear up to 0.020″, accurate to 0.001″. So lightweight and compact, you can carry it to any job, position it for any set-up. And so versatile, it can measure burrs, bevels and fillets. It will *pay you* to find out more about it soon.

BAUSCH & LOMB SINCE 1853

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☐ I'd like a demonstration of the B&L Die-Wear Microscope.

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Made in America, to the world's highest standards.

NAMES IN THE NEWS

Bendix Corp has appointed **I C Maust** vice president and general manager of **Micrometrical Manufacturing Co,** Ann Arbor, Mich. Mr Maust, who joined Bendix last February, had been general manager of RCA's Industrial & Machine Tool Division. He succeeds **F A Zander** who has retired.

Atlantic Stamping Co, Rochester, NY, has elected **Frederick L Lindsay** president to succeed the late **Leonard A O'Connell.** Mr Lindsay was former ly vice president and plant manager.

Ajax Magnethermic Corp, Youngstown, Ohio, manufacturer of induction heating and melting equipment, has promoted **Harley F Gauker,** former sales manager of the Induction Melting Division, Trenton, to assistant division manager. **James R Coley** has been named sales manager of the division.

Willys Motors Inc, Toledo, has appointed **A C Sampietro** chief engineer. He has been executive staff engineer in charge of new designs and developments at Willys from 1950 to 1954 and more recently has been a consultant to the company and several other firms in the US and Europe.

Lodge & Shipley Co, Cincinnati, has appointed **John E Bashforth** field sales engineer for the company's line of lathes. Mr Bashforth has had extensive experience in the machine tool field in the US and South America and will work from the Cincinnati office.

Kelite Corp, Berkeley Heights, NJ, manufacturer of industrial cleaning components and steam cleaning equipment, has elected **William Sorensen** president. He has been executive vice president and marketing director and succeeds **L C Sorensen** who will now serve as board chairman. **Louis McDonald,** new executive vice president, will continue as technical director.

Lockheed Missiles and Space Division has promoted **L J Staehle** to assistant to the general manager of the division. He will be stationed at the Van Nuys (Calif) plant. For the past year Mr Staehle has been in charge of the Lockheed office in the Inglewood area where he acted in a liaison capacity between the company's satellite systems organization and the Air Force space systems division. •

HOW DEEP THE SCRATCH?

Find out fast if it's within tolerance . . . measure with this New Bausch & Lomb Scratch Depth Gage

Here's real help in checking surface flaws. Are they serious enough to threaten functional failure under stress, in such materials as airplane wing skins or high pressure tubing? Are they within quality control limits? This new B&L inspection aid shows you quickly, simply . . . and for *sure*. Get direct readings of depths from 0.0002″ to 0.016″, accurate to +0.0001″ or 5% of the depth, whichever is larger. Measure widths from 0.001″ to 0.050″, accurate to +0.001″. You get a clear view of indentation contours, even edge burrs. If surface inspection is significant in your operation, mail this coupon right away.

BAUSCH & LOMB SINCE 1853

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62820 Bausch St., Rochester 2, N. Y.

☐ I'd like a demonstration of the B&L Scratch Depth Gage.

☐ Please send Leaflet D-2012.

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Made in America, to the world's highest standards.

Another case history on TORIT Dust Collectors

"What have you done about this DUST?"

In our plant trouble is spelled D-U-S-T. And our plastics production V.P. wanted to know what I had done to get rid of it. He was mad, and frankly, I didn't blame him. Dust was costing us a lot of money each year—in machine wear, misalignment and down time—to say nothing about absenteeism and poor morale among the workers. How could the plant help but be dusty—with grinders, lathes, milling and molding machines running 16 hours a day.

But I explained that I had checked on several dust control systems. The problem was that in 6 months we planned to expand and re-model the shop. It seemed like throwing good money after bad to invest in a control system now. But the V.P. wanted action. He told me about a Torit engineer who had called on him claiming he had a dust control system that offered complete *flexibility.* Then he gave me his card and suggested I call him immediately.

Believe me, I called that Torit man, but fast. He explained to me the flexibility his system offered—how with just minor changes it could be adapted to the new plant layout. I bought one of his Torit Model 24 Cyclone machines for less than $1,000. It services 2 molding machines, a double-end grinder, 2 lathes and a milling machine. And it really performs—has practically eliminated the dust in our shop. We're finishing our expansion and I have ordered another Torit Dust Collector to service our additional machines. You'd hardly recognize our shop now. It's clean. Production is up—morale is up—absenteeism is lower than ever.

Cyclone Model 24

Torit can solve your dust problems. For complete facts on dust . . . and how to control it . . . write

TORIT manufacturing company

1133 Rankin St., St. Paul 16, Minn., Dept. 432

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 UNIVERSAL MILLING MACHINE —*Brown & Sharpe Mfg Co, Machine Tool Division, Providence 1, RI.* 20-page bulletin MM 55 illustrates construction features, describes operations and optional equipment, and details specifications of new Dynamaster No. 2 machines. They are available with either 3, 5, 7½, or dual 10/5-hp spindle drive motors and an automatic climb milling arrangement.

2 HYDRAULIC PRESSES — *South Bend Lathe Inc, South Bend 22, Ind.* 8-page catalog 6106 pictures and describes complete line of presses, 30, 50, 75, and 100-ton Hydrolair, and the 30-ton Hydraulic Laboratory. Specifications on all air powered Hydrolair and hydraulic presses, hot plates, and accessories are listed in separate sections. Diagrams of the Power-Petuator air-hydraulic intensifier provide a clear explanation of this feature.

3 3-WAY BED LATHES — *Farrel-Birmingham Co, Consolidated Machine Tool Division, 566 Blossom Rd, Rochester 10, NY.* 8-page bulletin 1218 discusses features and construction of new Farrel-Betts heavy-duty 3-way bed lathes which range in capacities from 32 to 92-in. swing. Complete specifications included.

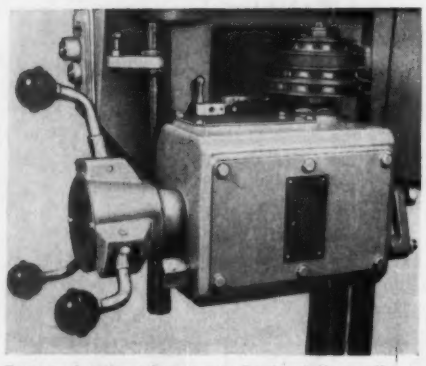
4 SURFACE GRINDING MACHINES —*Brown & Sharpe Mfg Co, Machine Tool Division, Providence 1, RI.* 20-page illustrated bulletin GM 62 gives complete specifications and covers principal construction features, operations, and optional accessory equipment for four new Micromaster units. Sizes are 8 x 24 in.; 10 x 24 in.; 12 x 24 in.; and 10 x 30 in. All include many new features for close tolerance tool and die shop or production work.

5 SURFACE GRINDER—*Landis Tool Co, Waynesboro, Pa.* 8-page catalog 618M-61 gives details on a 6 x 18-in. precision hand feed unit. Model 67 has a 7-in.-dia wheel with 1-hp, 3600-rpm spindle drive motor; Model 62 has 12-in.-dia wheel and 2-hp, 1800-rpm motor.

AM/MM

"You haven't seen a pneumatic pedestal riveter lying around, have you?"

You can do more with these ALL NEW DELTA 17″ drill presses



Equipped with exclusive new Rockwell Power Feed, these presses can operate in remote control or be interlocked with automation devices. Available as original equipment or as an accessory on every model.

FREE BROCHURE—Complete specifications on the new Delta 17" drill presses and accessories. Write: Rockwell Manufacturing Co., Delta Power Tool Division, 1819 N. Lexington Ave., Pittsburgh 8, Pa.

Here's a major engineering advance from Delta to give you increased drilling accuracy, more job flexibility and greater operating economy. You can choose from 76 models that incorporate these up-to-date performance features: New Internal Depth Stop Mechanism, Quick-set Depth Gage, Interference-free Guard and Pivot-type Motor Mount.

These drill presses are completely new—not merely improved or restyled—but actually redesigned to deliver consistent precision operation under the most rugged work loads with little or no maintenance.

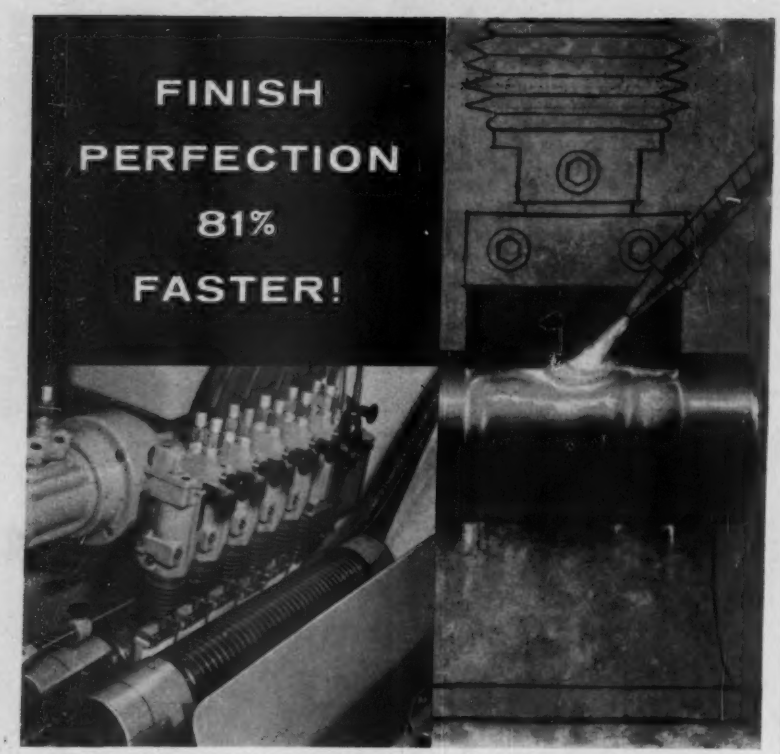
Your Delta Industrial Distributor (listed under "TOOLS" or "MACHINERY" in the Yellow Pages) will gladly demonstrate how these 17's can save you dollars, hours and material. Why not call or see him soon!

DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL

CIRCLE 385 READER SERVICE CARD



Model 88 Through-Feed Centerless Microstoning Machine for automatic production and Microstoning head of the Model 9681 Microstoner, for attachment to lathes and other machine tools.

Microstoning Produces Controlled Microinch Surfaces Fast, Precisely, Profitably

Remarkable but true . . . operations are eliminated with Microstoning. You get results at least equal to — but usually much better than — you get with costly, time-consuming precision machining, grinding and handwork. And you get these results in the shortest possible time: One company cut finishing time from 30 hours to 4 hours, another from 30 seconds to 5 seconds!

Microstoning is the exclusive Taft-Peirce/Supfina process in which special Microstones in a wide range of grits and bonds oscillate pneumatically against work pieces. Because microstones take the shape of the work and oscillate at a natural frequency, microstoning corrects out-of-roundness and gives you controlled microinch surfaces — even fractional microinch if specified — in one quick cycle.

Ask your Taft-Peirce agent to demonstrate how you can *improve quality* while *reducing costs* with Taft-Peirce/Supfina. Or write for detailed information.

Finish it with

TP1-9

TAFT-PEIRCE *SUPFINA*

TAFT-PEIRCE MANUFACTURING CO. 13 MECHANIC AVENUE, WOONSOCKET, R. I.

Free Literature

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6 MILLING MACHINES—*S & S Machinery Co, 140 53rd St, Brooklyn, NY.* 12-page bulletin on the new 1961 Supermill horizontal knee type units provides information on the 4U and 5U with electric pendant control, all-electric drive, clutches, and brakes. These machines can be easily adapted to tape control.

7 ROLL FEEDS—*Ferguson Machine Co, 7818 Maplewood Industrial Court, St Louis 17, Mo.* 8-page catalog 500 describes new cam indexed Camtrol models for precision feeding of dynamically controlled roll and strip stock at rates exceeding 3000 ipm. Data includes graphs for determining operating speeds and formulas for analyzing machine dynamics, selecting the proper acceleration characteristic and determining correct roll pressures. Specifications of standard roll feeds for stock up to 12 in. wide, and feeding in varying increments, are given.

8 BROACHING MACHINES—*General Broach & Engineering Co, 14339 Prairie Ave, Detroit 38, Mich.* 4-page illustrated brochure shows engineering features and lists specifications for new GBP Series of standard machines.

9 DIE PROTECTION—*Di-Matic Controls Inc, 100 Beadel St, Brooklyn 22, NY.* Illustrated bulletin C1 pictures and describes the Di-Matic system for preventing damage to dies on power presses, transfer machines, and other automatic production equipment. The electrically controlled system instantly disengages the press clutch in the event of misfeed, stock buckling, material pile-up, or end of coil. Complete line of standard control units for both friction clutch and mechanical clutch presses is detailed.

TOOLS AND ACCESSORIES

10 DIAPHRAGM CHUCKS — *Erickson Tool Co, 34350 Solon Rd, Solon, Ohio.* 6-page catalog covers line of air-operated models for high-speed internal and external chucking. Gives dimensions of 3-jaw, 4-jaw, and 6-jaw units and de-

AM/MM

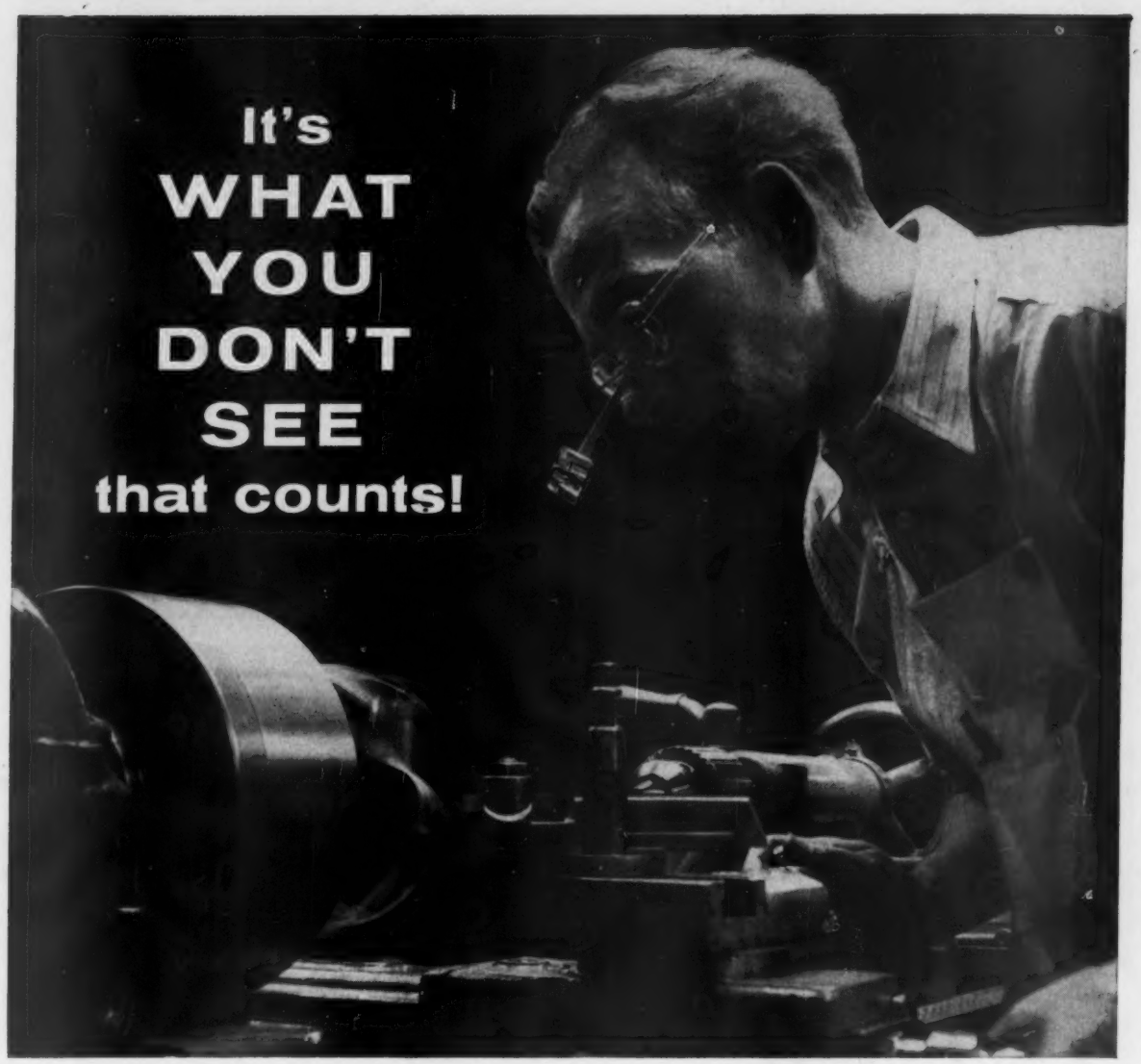


Photo from LEARCAL DIVISION, LEAR INC., Los Angeles

Quality control and production records can quickly prove the efficiency of South Bend 16" Lathes. What you can't see is their *dependability* that assures low cost precision machining for years to come. They can do it because of such features as—

- Integrity of manufacture—honest workmanship using the finest materials.
- Spindle bearings designed specifically for precision work—microfinished sleeve type for close tolerance, *fine finish* work.
- Built to take it for *proven* low maintenance.
- Trouble-free belt drive to the spindle—quiet, no vibration, no gear marks.
- *Write for catalog of South Bend Lathes, milling machines, shapers, drill presses and pedestal grinders.*

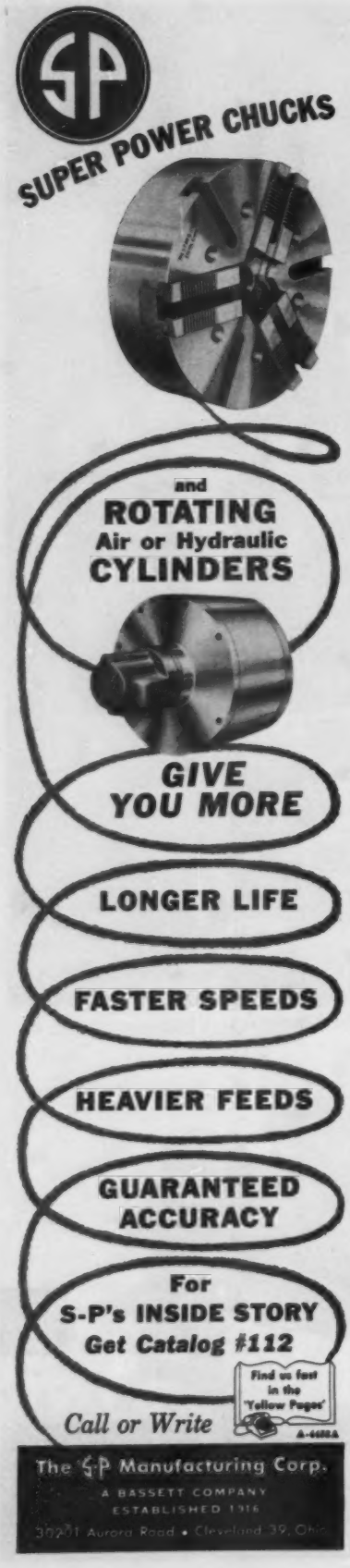
Specifications	16" Lathes
Collet capacity	1 1/16"
Spindle speeds	15 to 980 r.p.m.
Cross and longitudinal feeds	48
Threading feeds	48
Base price	$2591

Up to 36 months to pay

SOUTH BEND LATHE

South Bend 22, Indiana

Building Better Tools Since 1906



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scribes applications of four special chucks. All units provide repetitive chucking accuracy as close as 0.00015 in. over a long service life. They can be constructed with a double-acting piston for push-pull operation where additional grip is needed.

11 PRECISION GRANITE SURFACE PLATES — *A Ottavino Co, 1026 Brooklyn Ave, Brooklyn 3, NY.* 4-page bulletin on plates and straight edges gives detailed reasons for selecting granite when non-magnetic, suction-free, rustproof, warp resistant, temperature-resistant, and non-abrasive qualities are required. Applications illustrated and described. Products are guaranteed to an accuracy of 0.00005 in. on plates up to 24 x 30 in.

12 DIAMOND GRIT—*Engelhard Hanovia Inc, Industrial Diamond Division, 113 Astor St, Newark 2, NJ.* Report, "Diamond Grit Performance: Some New Evaluation Results," first of a series of test results from the Division's evaluation program, appears in Volume II Number I of the firm's technical publication "Diamond Data." According to the report, selecting the correct grit and achieving higher levels of performance require consideration of many variables not relevant when there was only one type of diamond grit available. Data presented suggests how grinding wheel evaluation that takes these additional variables into account can point the way to improved performance.

13 TAPS — *Besly-Welles Corp, South Beloit, Ill.* 24-page catalog 804 illustrates and describes standard and special taps. Includes a tap users' guide, trouble shooting section, resharpening instructions, and tables on thread constants, Acme threads and drill diameters, as well as a glossary of terms.

14 DIAMOND WHEELS AND HONES —*Norton Co, Worcester 6, Mass.* Catalog contains general information on diamond wheels, recommended starting specifications for a wide variety of work, prices, and a section on wheels for silicon and germanium cutting.

HEAT TREATING AND WELDING

15 INNERSHIELD WELDING — *Lincoln Electric Co, Cleveland 17, Ohio.* 12-page bulletin describes vapor-shielded arc welding and the new semi-automatic "Innershield Squirt," as well as the full automatic Innershield welders made by the company. Typical process applications illustrated; performance characteristics and process speeds are compared with manual shielded metal arc and semi and full automatic submerged arc welding.

16 HEATING FURNACE CONTROLS —*GPE Controls Inc, 240 E Ontario St, Chicago 11, Ill.* 24-page catalog, Folio 122, is a handbook on automatic control for open hearth furnaces, glass tanks, reheating and annealing furnaces, and soaking pits. Includes photos and diagrams of installations together with detailed discussions of the various types of control subsystems. Both hydraulic and electro-hydraulic types of systems are covered with diagrams illustrating the best types of applications for each control method.

17 FIRING PROCESS — *Bickley Furnaces Inc, 550 State Rd, Philadelphia 14, Pa.* 12-page illustrated bulletin J-1 discusses Iso-Jet firing, a new firing technique for ceramic kilns and other process furnaces. This process permits temperature uniformity during the complete heating and cooling cycle to be held within a few degrees F in all sections and areas of the working chamber. The jet effect prevents the natural buoyancy of the hot burner gases from carrying the high heat to the crown of the furnace and the special diffusion air arrangement permits excess air ratios up to 3000% and higher. Charts and graphs explain and detail the system.

PLANT SERVICE EQUIPMENT

18 FANS — *American-Standard Industrial Division, Detroit 32, Mich.* 44-page illustrated catalog A-1203 describes line of HS fans, Series 81, Class I and II. Discusses construction features of HS fans and describes available drive arrangements, configurations, and types of drive. Capacity tables are included for the full line of 12 sizes, single-inlet single-width design and 12 sizes of double-inlet, double-width design.

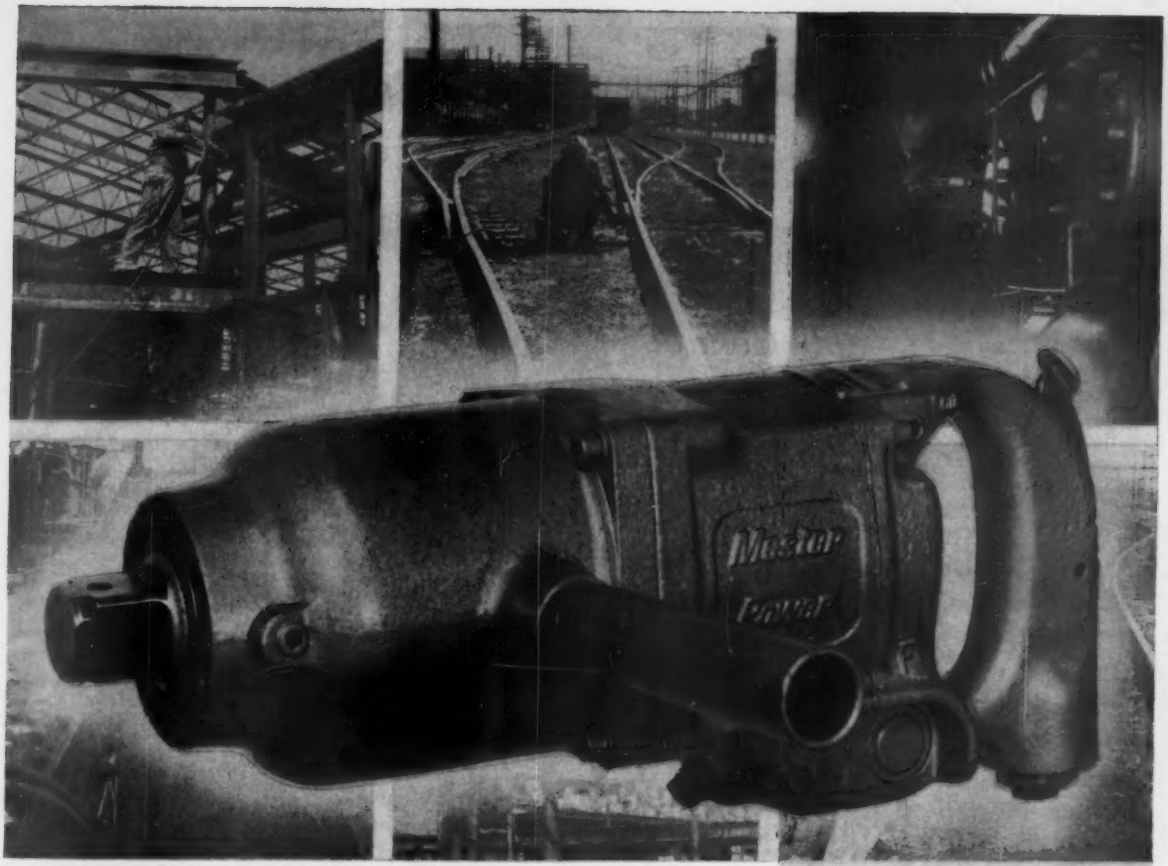
19 VACUUM PUMP AND AIR COMPRESSOR SELECTOR—*Gast Manufacturing Corp, 2301 Fair Ave, Benton Harbor, Mich.* Choice of Gast rotary air pump models is indicated by setting this slide rule at the required air flow in cfm at zero psig. Setting pointer on opposite side of the selector then gives the motor hp requirements and complete air flow characteristics over the range of 0 to 28 in. hg vacuum or 0 to 30 psig pressure.

20 ANODES AND PLATING CHEMICALS — *Hanson-Van Winkle-Munning Co, Church St, Matawan, NJ.* 8-page bulletin AC-113 illustrates and describes full line of H-VW-M anodes, accessories, and chemicals for electroplating and metal-finishing. Nickel, cadmium, brass and copper, lead and zinc anodes are covered; various types of nickel anodes are listed together with recommended applications and pH ranges. Page of drawings gives instructions on how to order hooks for round, flat, and shaped lead anodes. Lists salts commonly used in electroplating baths and a number of brighteners used in H-VW-M solutions.

21 "CREATIVE FRAMING" — *Acme Steel Co, Fabricated Materials Division 135th St & Perry Ave, Chicago 27, Ill.* 24-page booklet AD-410 presents a variety of how-to-do-it-yourself ideas and applications for creative framing of storage racks, shipping containers, tables, platforms, and other structures of all sizes and shapes through use of AIM brand slotted angle framing material with precisely engineered pattern of slots and holes.

AM/MM

"No breakfast and no coffee; I've got appointments with 5 salesmen this morning and I want to be in the right mood."



FEATURES OF THE ALL-NEW MASTER POWER 990 IMPACT WRENCH

- For 1¼" high-tensile bolts
- Weighs only 21 pounds
- New "roll-action" engages and disengages impact mechanism
- Popular, protected, push-type reverse valve
- Compact design gives greater maneuverability.
- Hardened, wear-resistant motor end-plates and liner.

NEW LIGHTWEIGHT CHAMP FOR HEAVY-DUTY WORK

This new Master Power 990 Impact Wrench went to work more than a year ago in shipyards, steel mills, rail yards, on off-the-road equipment, on steel erection and truck assembly. The toughest kind of work in the roughest environments. Our documented performance data is your proof that the new 990 delivers ultimate power, positive engagement, maximum life.

A combination of "roll action" and precision-engineered, cam-timed impact mechanism gives you a tool with no springs, no snap rings, no lost motion. The tried and proved ball-and-race principle of smooth, almost frictionless rolling action engages and disengages impacting blows with precise timing. The powerful air motor and clutch hammer are independently suspended on heavy-duty bearings. You get positive, full engagement regardless of power input. Result: A compact, light weight (21 lbs.) tool doing up to 1¼" high tensile bolting with less vibration, less torque to operator. Its simplified design permits assembly and disassembly with ordinary tools. Try this new tool *now!*

Ask your nearest Master Power distributor for a demonstration or write us for complete performance information.

Leading Distributors Everywhere

MP **Master Power**

Master Power Corporation • Solon, Ohio
A Black & Decker® Subsidiary

WYCKOFF
Your FIRST Choice

For Quality Controlled

COLD FINISHED STEELS

CARBON . . . ALLOY . . . LEADED

Finest Machinability

Ideal Physical Properties

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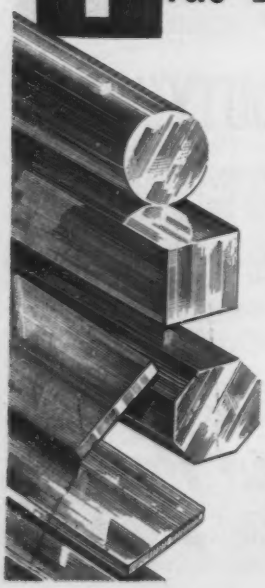
Superior Surface Finish

True Dimensional Tolerances



You will save time, metal and money on all of your operations by making WYCKOFF your FIRST choice always.

Steel

WYCKOFF STEEL COMPANY

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WYCKOFF STEEL PRODUCTS • Carbon, Alloy and Leaded Steels • Turned and Polished Shafting • Turned and Ground Shafting • Large Squares • Wide Flats up to 12¾" x 2½" and 14" x 1½" • All types of Furnace Treated Steels including Carbon Corrected Steels

Free Literature

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22 AIRLESS SPRAY EQUIPMENT — *DeVilbiss Co, Toledo 1, Ohio.* Catalog lists specifications and provides information on the new medium production pump for single gun operation; the heavy duty pump for multiple gun operation, including portable and tank mounted models; spray guns, including pole and automatic models; range of spray caps available, and types of hose and connections.

PARTS AND MATERIALS

23 STEEL-BONDED CARBIDES — *Chromalloy Corp, Sintercast Division, 171 Western Highway, West Nyack, NY.* Reprints of "Heat Treatable Steel-Bonded Carbides," a paper presented at the 16th annual meeting of the Metal Powder Industries Federation, discusses the significant physical and mechanical properties of Ferro-Tic C, including machinability and hardening under heat treatment. Lists specific applications for the material in tooling and as wear-resistant inserts. In its annealed state, this steel-bonded carbide can be machined with ordinary toolroom equipment, then hardened up to Rhn 70 using conventional heat treating procedures.

24 BERYLLIUM BOLTS — *Standard Pressed Steel Co, Box 875, Jenkintown, Pa.* 16-page booklet, "1910 Years of Beryllium," (Form 2719) reviews the development of the first beryllium structural bolting recently introduced by SPS. First half of the booklet traces the discovery of the metal and early exploration of its properties; remainder of the monograph deals with the company's R & D program to overcome the shortcomings of the material in structural applications. Technical section reviews outstanding characteristics of the metal.

25 DRY FLUID DRIVES—*Dodge Manufacturing Corp, Mishawaka, Ind.* 20-page bulletin 70 discusses a simplified method for selecting Flexidyne drives and couplings. Eight stock drives and 11 stock

AM/MM

"Well, I finally made some impression on the boss. He tries to avoid me now."

NEW

COLD OPERATING

ELECTROPERM Chucks

Combining the advantages of both electric and permanent magnetic chucks, this new cold operating chuck represents the ultimate in precision for large magnetic chucks. The chuck is only energized and deenergized electrically while permanent magnets do the actual holding during machinery operation. Energizing and deenergizing cycles are so short that heat and accompanying distortion are eliminated. The cold operating Electroperm Chuck is so stable dimensionally that it will hold the precision tolerances of the machine tool upon which it is mounted.

Write for Catalogue WPL60 showing the complete Walker line of demagnetizers, magnetic and vacuum chucks.

O.S. Walker
COMPANY, INC.
ROCKDALE ST., WORCESTER 6, MASS.

WALKER CERAMAX CHUCKS

Versatile Walker Ceramax Chucks featuring ultra-permanent ceramic magnets are successfully applied on grinders, millers, lathes, shapers and many other type machines. Powerful, rugged and stable, these permanent magnetic chucks can handle large heavy pieces or small thin stock with equal ease. The all steel top plate minimizes redressing and provides a long wearing precision work surface. Focused flux keeps the magnetism down near the top plate and away from the spindle and other machine parts. Alternating north and south poles of *equal* strength keep cutting tools demagnetized.

MILLING **TURNING** **GRINDING**

NEW . . . ALL NEW . . . FROM

KALAMAZOO

The "BIG K"

Now, after more than four years' research, Kalamazoo brings to you the all new Model 14A — horizontal metal cutting bandsaw. Incorporating some 30 shop proven, cost saving features, this hydraulic driven, heavy duty bandsaw offers cutting capacity and ability in excess of any cut-off method, at far less tool cost per square inch of cutting.

Most important among these profit producing features are: positive control force feed; clockwise blade rotation to reduce teeth shock — increase blade life; convenient 36" machine height to reduce operator fatigue; large 14" x 24" capacity; push button control; dual movable vise jaws; adjustable blade tension.

For complete details on this amazing new machine tool, phone, write or wire your Kalamazoo representative. Facilities for test runs of your material on the "Big K" are at your disposal — at no obligation.

MACHINE TOOL DIVISION
Kalamazoo Tank & Silo Company

508 Harrison St.
Kalamazoo, Mich.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

couplings are listed for fractional to 1000 hp requirements, together with installation photos, product pictures, and engineering drawings. Includes tables of weights, dimensions and prices, tables of recommended V-belt drives for use with Flexidynes of various sizes.

26 FASTENERS — *Southco Division, South Chester Corp, Lester, Pa.* 56-page handbook No. 11 contains complete data on a wide variety of specialty fasteners; includes sizes, dimensions, and installation data.

27 MAGNETIC DRIVES — *Louis Allis Co, 427 E Stewart, Milwaukee 1, Wis.* 6-page bulletin 3650 covers magnetic adjustable speed drives available in ratings from 50 through 2500 hp. Describes basic components, theory of operation, controls, and design features. Controls supplied for the drive are furnished in the standard electronic controller as well as the optional transistorized controller.

28 CONTROLLED SPEED SYSTEMS — *US Electrical Motors Inc, PO Box 2058 Terminal Annex, Los Angeles 54, Calif.* Revised brochure, Form F-1952, incorporates the advances made in central control instrumentation and panel design, and in signal transmission methods within process-controlled automatic systems. Included in the 12 typical systems that are illustrated are five US Varidyne ac frequency-control multi-motor systems, as well as single-motor systems utilizing US Varidrives and torque motors. Also featured is the Dial-A-Torq control providing adjustable motor slip on a calibrated basis.

29 "FATIGUE-PROOF" STEEL BARS —*La Salle Steel Co, PO Box 6800-A, Chicago 80, Ill.* Case Study Portfolio No. 3 includes a total of 11 case studies that deal with how these bars compare in machinability and tool life with the materials they commonly replace. Specific parts applications studied are 1) a heavy-duty lathe main drive shaft; 2) an adjusting screw for a sheave; 3) a coil winding machine adapter; 4) a cage screw pin; 5) a miter gearbox main shaft; 6) a transmission main shaft; 7) a floor surfacing machine armature shaft; 8) an outboard motor push rod; 9) a hydraulic cylinder piston rod; 10) a radial drill valve body; 11) a radial drill transverse handle. ●

AM/MM

Moore Jig Borer area at Fibreform Electronics; checking fixtures and inspection tools in the foreground.

"We feel strongly that our seven Moore Jig Borers are the heart of our business today." *—says Fred H. Sperbeck, partner, Fibreform Electronics, Inc., Los Angeles*

"The trend towards closer tolerances, small quantities, and quick deliveries on precision-machined parts for the electronics and missile industries has created a most difficult problem for companies manufacturing these parts.

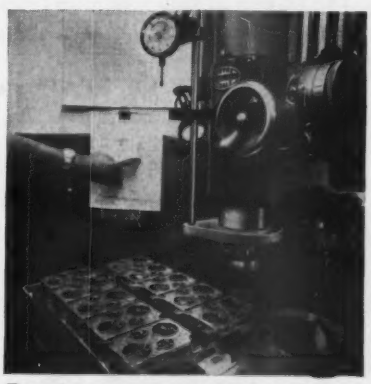
"Our answer to this problem is the Moore Jig Borer. Through careful planning and precision gaging, we have given our jig boring area the same production capabilities as our other departments. This not only eliminates the time and cost of many precise jigs and fixtures, but also, in many cases, reduces labor costs of highly skilled operators.

"At Fibreform Electronics, we feel strongly that the seven Moore Jig Borers we have purchased since 1956 are the heart of our business today, and will continue to be in the future."

For locating and boring holes in dies, jigs and production parts, the speed and accuracy of the Moore Jig Borer has never been equalled. You can easily split "tenths" with the new Moore No. 3 Jig Borer.

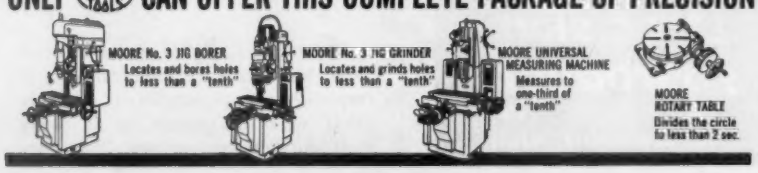
Prove it to yourself by writing for illustrated brochure. Also, on request, we will send you data on the Moore No. 3 Jig Grinder, which locates and grinds holes to less than a "tenth."

Moore Special Tool Company, Inc.
738 Union Avenue, Bridgeport 7, Connecticut



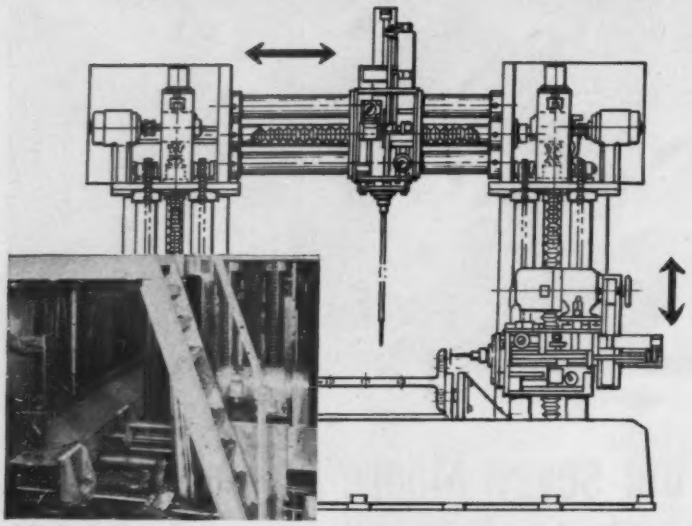
Ten pieces on one set-up means that cutting tools are loaded only 10% as often. This also cuts inspection needs to 10% of the holes. Parts are spaced on even inch increments to simplify charting.

ONLY MOORE TOOLS CAN OFFER THIS COMPLETE PACKAGE OF PRECISION


MOORE No. 3 JIG BORER
Locates and bores holes to less than a "tenth"
MOORE No. 3 JIG GRINDER
Locates and grinds holes to less than a "tenth"
MOORE UNIVERSAL MEASURING MACHINE
Measures to one-third of a "tenth"
MOORE ROTARY TABLE
Divides the circle to less than 2 sec.

HOLES, CONTOURS AND SURFACES
Moore's authoritative book tells how to produce tools, dies and precision parts the modern way. 424 pages, 495 illustrations. $5 in U. S. A. $6 elsewhere.

Beaver Ball Screws help Mahon save 85% in drilling holes in bridge beams, columns

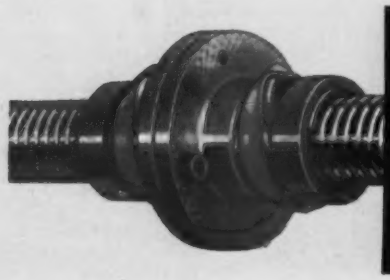


Close tolerance positioning of massive 1½" capacity vertical and horizontal drill heads is accomplished with Beaver ground-thread ball screws in this new, numerically controlled drilling machine, first in the structural steel industry.

Walter P. Hill, Inc., designed and built the machine for The R. C. Mahon Co., Structural Steel Division

In addition to the important drilling cost savings, it offers repeatability in hole pattern accuracy within ±.005" as compared with ±⅛" by conventional methods and eliminates costly hole reaming in final assembly.

If you are considering data control, Beaver ball screws will give you the power efficiency, positioning control and compactness you need. Our engineers will be glad to work with you just as they did, in this case, with the Walter P. Hill designers.



Beaver Precision Products INC. CLAWSON, MICH.

NEW BOOKS...

PLASTICS TOOLING (2ND EDITION). *By Malcolm W Riley. Published by Reinhold Publishing Corp, 430 Park Ave, New York 22, NY. 216 p, 6 x 9. Price $7.50*

A complete revision of the earlier edition, this guide to properties and fabrication methods of plastic tooling now includes the latest developments in the field, such as metal fiber-reinforced epoxies, as well as some that are still in the development state but appear to have a promising future. Physical and mechanical properties of plastics are included, together with novel methods by which they can be put into final tooling shape. There is also enough resin chemistry discussed to permit the engineer to work with plastics and with suppliers on a sound basis—HEL

DIE PRAXIS DER INDUKTIVEN WARMBEHANDLUNG (INDUCTION HEATING PRACTICE). *By Kurt Kegel. Published in German by Springer-Verlag, Heidelberger Platz 3, Berlin-Wilmersdorf, Germany. 167 p 6 x 9. Price DM 31.50.*

Copiously illustrated, this new work explains the principles of induction heating and points out the difference between low-, medium-, and high-frequency installations. Forging and soldering are covered in detail, as is the entire induction hardening process. Electrical principles and physical design of induction coils are explained, together with their application to gears, crankshafts, and camshafts. Information is also presented on the hardening of small parts, and internal hardening.

The various types of medium- and low-frequency generators are shown, together with simple and fully automatic heat-treating machines—HEL.

HANDBOOK OF MECHANICAL WEAR. *Edited by Charles Lipson and L V Colwell. Published by University of Michigan Press, Ann Arbor, Mich. 469 p, 7 x 10. Price $20.*

The various aspects of mechanical wear, together with their causes and remedies, are presented in a group of 17 scientific papers by as many distinguished authorities. They are

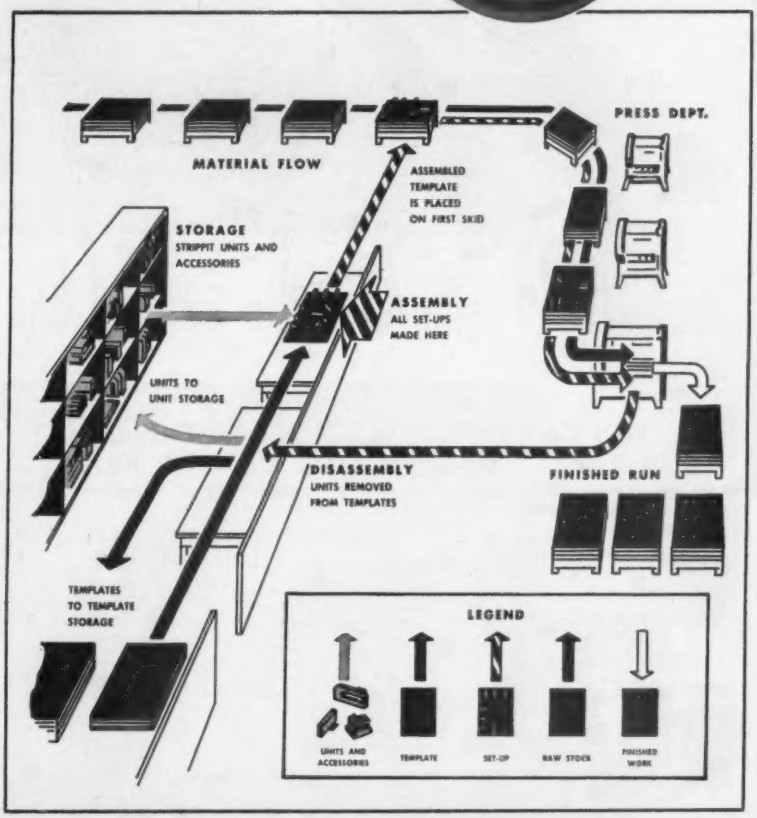
BEAT THE WATCH

with time-saving STRIPPIT hole punching units

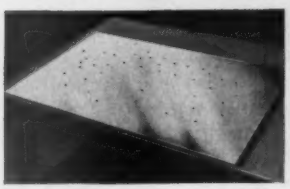
A stop-watch measures *dollars and cents* when it measures the time you spend setting up tooling. But the STRIPPIT System reduces hours to minutes and seconds... releases high bracket tool designers, die makers and die setters for work on more complicated dies involving forming, drawing and other operations.

All it takes is a good mechanic to make STRIPPIT setups on bedrails, T-slotted plates or drilled templates. The latter are particularly valuable in saving press down time because the complete setup can be inserted as soon as the previous press run is finished.

STRIPPIT self-contained hole punching units come in a multitude of sizes and capacities to meet any pattern requirement. Newest of these are the "BN" and "CJ" series which can be used for punching round or shaped holes. Also available are notching units and units for punching angles and extrusions. Write now for the STRIPPIT General Catalog.

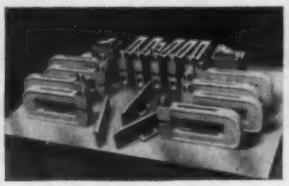


Typical STRIPPIT setup takes only 25.33 minutes from work order to finished piece



The STRIPPIT System begins with examining the blueprint, selecting the pre-drilled template and placing on setup table.

Feed rails and work stops are mounted securely to the template according to the size and the shape of the blank.



Notching units and hole punching units are mounted. Pilot pins concentric with punch assure precise positioning.

Complete setup is inserted in press and bolted down, shut height is adjusted and first piece punched and checked.

WALES **STRIPPIT** INC.

A UNIT OF HOUDAILLE INDUSTRIES, INC.

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divided into six major sections as: fundamental aspects; pitting, scoring, and spalling; corrosion; abrasion; wear resistance materials; and manufacturing processes. Each paper considers a different problem in great detail and, taken together, they represent the experience of the leading experts in the field.

The book opens with an introduction by its editor, in which he defines the problem of wear and establishes a standard nomenclature. In the final chapter he presents a summary of the findings of the 17 papers. It is definitely not a book for the layman, but the engineer who is concerned with mechanical wear in its individual and inter-related phases will find in it a wealth of information that has never before been brought together—HEL.

CORRECTED OPTICAL PYROMETER READINGS. *By D E Poland, J W Green and J L Margrave. Published by Superintendent of Documents, Government Printing Office, Washington 25, DC, as Nat'l Bureau of Standards Monograph 30. 74 p. Price 55¢.*

These tables enable optical pyrometer users to convert immediately the observed temperature to the true temperature, taking into consideration the effective emissivity of the observed material. They can also be used to determine effective emissivity when true temperature is known, by comparing this temperature with the pyrometer reading.

Tables give observed temperatures from 1000 to 3000° K in increments of 50°, and from 10,000 to 39,900 K in increments of 100°. True temperatures are tabulated for 49 emissivities from 0.02 to 0.98 in increments of 0.02. Calculations were made on a 650 computer—HEL. •

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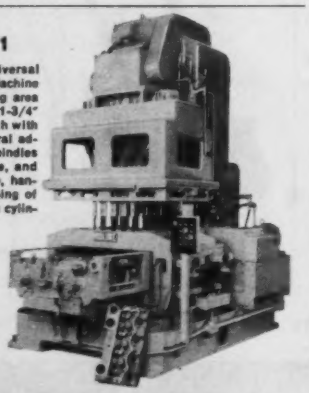

HD13

straight line drilling machine with hydraulic table feed and 18 spindles each having 11/16" diameter drill capacity in mild steel. Spindle center distances are adjustable along the 6-foot machine rail.

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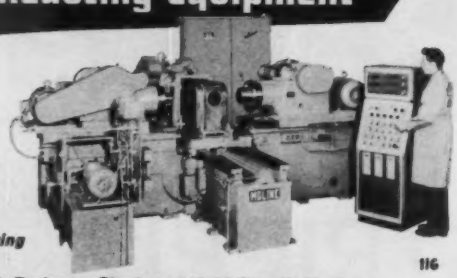
Three-way, three-spindle, horizontal boring machine with selective automatic feed cycle. Handles boring of cylinder and crank bore for 3 sizes of 1-cylinder blocks. Also bores for wet sleeves in 2- and 3-cylinder blocks.



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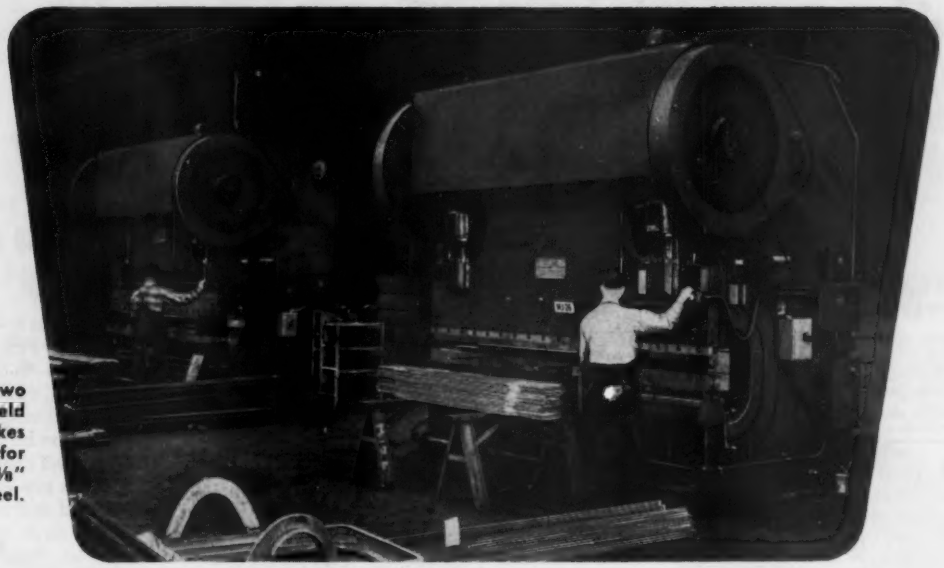
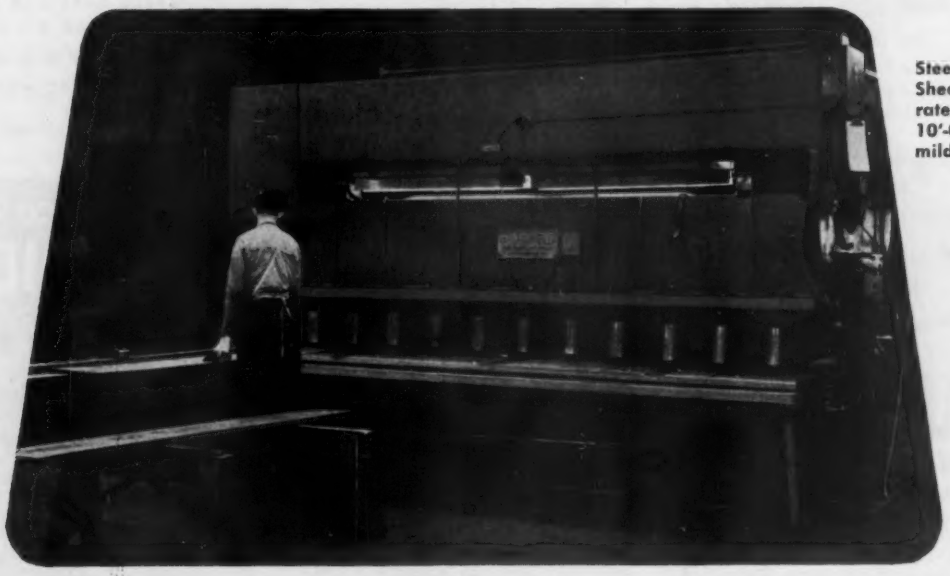


These two Steelweld Press Brakes rated for 12'-0" x 3/8" mild steel.

STEELWELD PRESSES and SHEARS aid Caterpillar Production



Steelweld Shear rated for 10'-0" x 1/2" mild steel.

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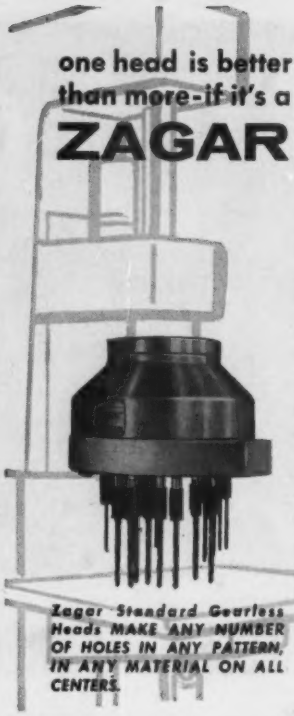

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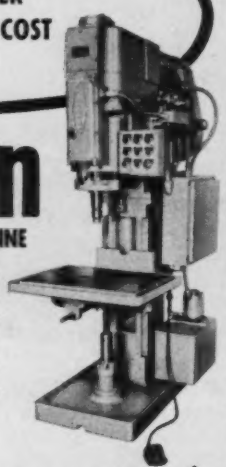

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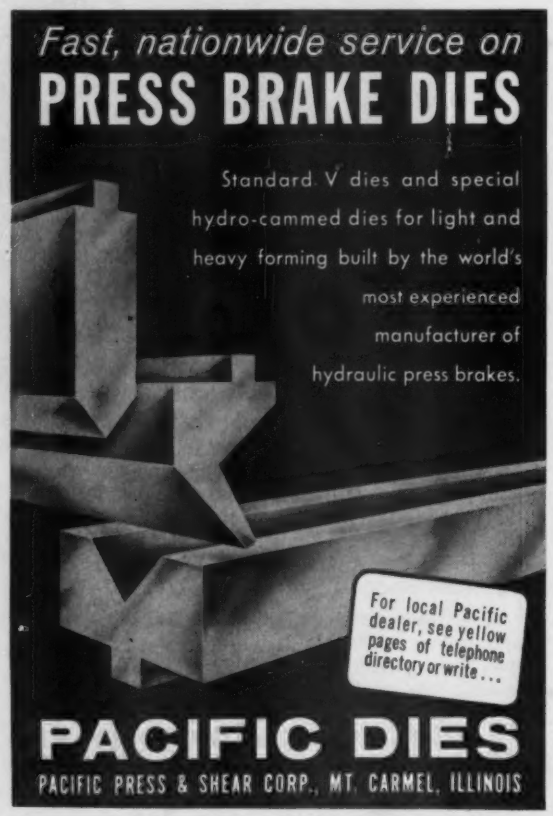

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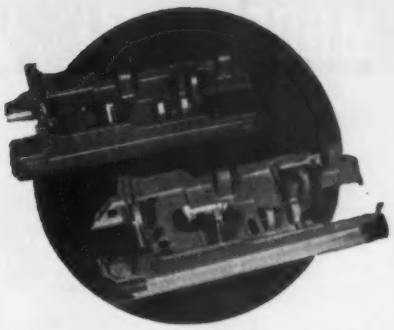
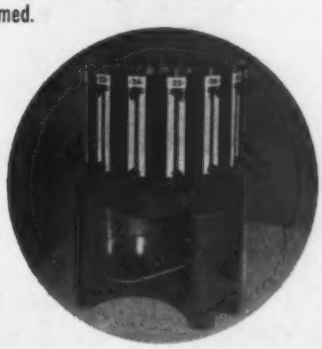


A TMW gray iron casting before and after precise machining, annealing and finishing operations were performed.



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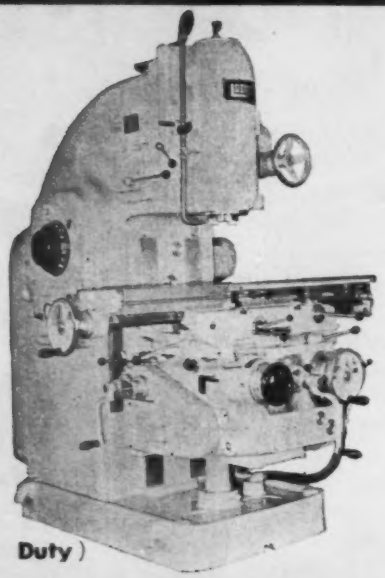

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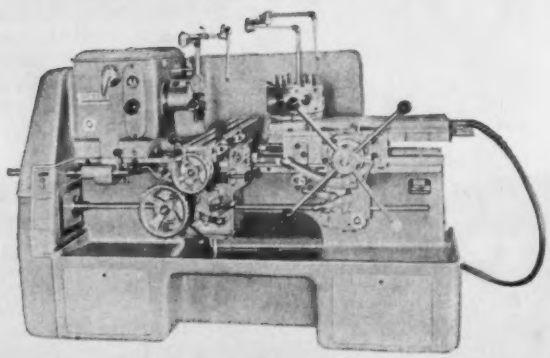
It is possible to select easily and speedily 16 different speeds from 40 rpm in minimum to 2000 rpm in maximum with a mono-lever connected to the reversal braking motion of motor.



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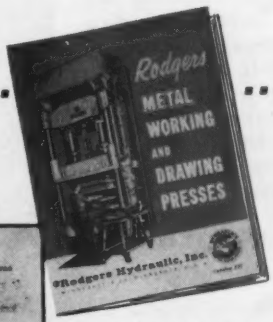
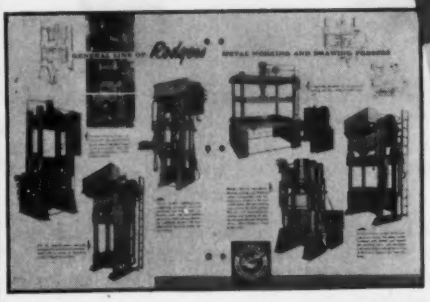
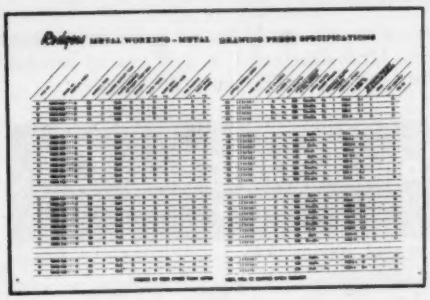
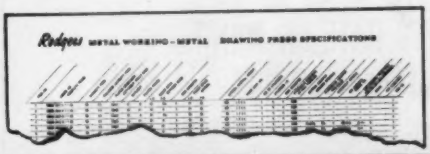


...this guide tells you



- tonnage capacities
- platen dimensions
- daylight
- platen travel
- clear span between rods
- rod diameter
- floor space
- pump type
- cylinder detail
- ram diameter
- full-tonnage pressure
- bolster opening
- draw
- other factual data





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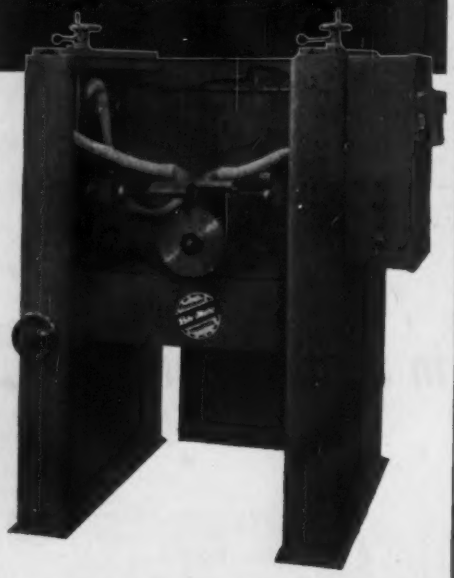

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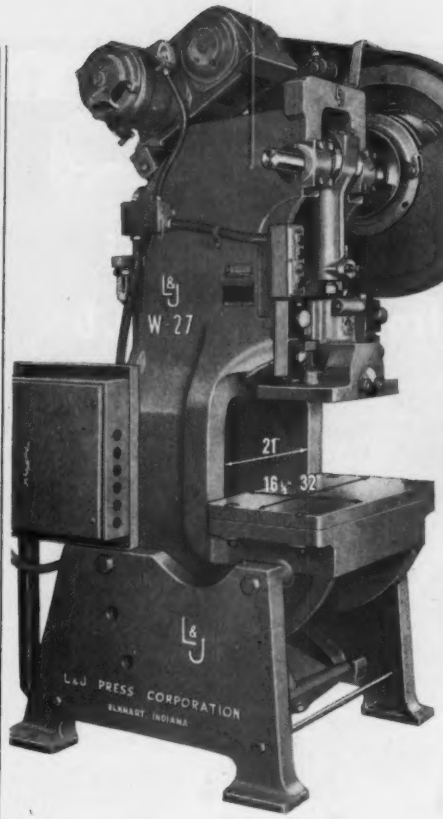

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- Ideal for trimming die castings—standard slide face 18" x 11½"—bolster area 32" x 16½"—throat depth 9"—opening through back 21"
- Basic design and construction insure efficiency and dependability
- Reinforced Meehanite frame affords rigidity for high work accuracy and long die life
- 27-ton capacity covers wide range of light work requirements
- Readily adaptable to special jobs at low cost
- Geared and non-geared models

WRITE for complete L&J catalog — 14-to 150-ton O.B.I. Presses, 20-to 150-ton Straight Side Presses and 30-to 75-ton Gap Frame Presses.

L&J PRESS CORPORATION 1629 STERLING AVE. ELKHART, INDIANA

CIRCLE 409 READER SERVICE CARD

DYKEM
STEEL BLUE
Stops Losses
making Dies and Templates
DYKEM STEEL BLUE
SPECIMEN
With DYKEM Steel Blue
Without DYKEM Steel Blue
Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.
Write for sample on company letterhead
THE DYKEM COMPANY
2301B North 11th St. • St. Louis 6, Mo.

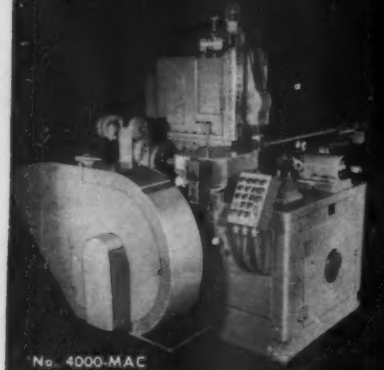
Fastest Cutting of Tubes of all shapes from ⅛" to 4" O.D.

No. 1000-MAC cuts tubes of all shapes up to ¼" O.D.

Grieder Tube Cut-Off Machines will give you from 4500 to 6500 cut-offs per hour—round, square, oval, hexagonal, rectangular—from tubes ⅛" to 4" O.D. No other machines provide such speeds. Note further:

- They cut tubing to any length.
- Steel, copper, brass, aluminum, alloys.
- Length tolerance plus or minus .002" on light wall tubing, .003" on heavier.
- Precision clamping dies prevent tube distortion, guarantee a quality cut. Tube does not rotate.
- Operation is fully automatic.

Write for literature describing the four Grieder Tube Cut-Off Machines and Automatic Loaders and Feeders.



No. 4000-MAC cuts tubes of all shapes up to 4" O.D.

PINES ENGINEERING CO., INC.
670 Walnut St., Aurora, Illinois

Grieder

TUBE CUT-OFF MACHINES

CIRCLE 411 READER SERVICE CARD

GRANT

RIVETERS — PIONEERS in their line — head rivets from smallest to ¾" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method — Sizes to meet all needs — Types include Vertical and Horizontal Multiple Spindles.

Write for literature and don't forget to send samples.

THE GRANT MFG. & MACHINE CO.
85 Sillimon Ave., Bridgeport, Conn. U. S. A.

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American Machinist / Metalworking Manufacturing

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SEARCHLIGHT SECTION

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Listed below are used surplus new and rebuilt machine tools or services as advertised in this section.

The numbers after the advertiser's name indicates the products or services offered by the advertiser.

3. Automatics
7. Boring Mills
8. Broaching Machines
11. Chucking Machines
16. Die Sinking Machinery
17. Drilling & Reaming Machines
20. Fabricating Equipment
25. Gear Cutting Machines
26. Grinding Machines
30. Keyseaters
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"No Cost or Obligation"

This service is aimed at helping you the reader of "SEARCHLIGHT," to locate rebuilt and used machine tools and equipment, not currently advertised. (This service is for USER-BUYERS only.) No charge or obligation.

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SEARCHLIGHT EQUIPMENT LOCATING SERVICE
c/o American Machinist/Metalworking Manufacturing
Classified Advertising Division, P.O. Box 12, N. Y. 36, N. Y.

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Seachlight Equipment Locating Service, c/o Classified Advertising
American Machinist/Metalworking Manufacturing, Box 12, N.Y. 36, N.Y.

Please help us locate the following equipment:

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NAME .....

TITLE ..... COMPANY .....

STREET .....

CITY ..... ZONE ..... STATE .....

8/21/61

USED MACHINERY FOR SALE (by user)

Newton Continuous Rotary Milling Machine.
E-3800. 25 HP, 1880 RPM, 220/440 V., 3 ph., 60 cy. Drip Proof, top mtd., 2 heads/cutters, speeds adj./pick off gears from 60 R.P.M. 48" Dia. Rotary Table. Feeds adj./pick off gears 7"/Min. up. 23" Max. dist. spindle/6" raising block. 46" max. dist. col. to center line, adj. in and out. Running — Price $1,000.00 — Price w/o motor $700.00.

Newton Continuous Rotary Milling Machine.
E-3158. 25 HP, 1800 RPM, 440 V., 48" dia. Rotary table, 40" max. dist. col. to center line, adj. in and out. 2 heads/cutters. Spindle speeds 60 RPM adj./pick off gears. 15½" max. dist. spindle. MD, 3 ph., speeds suitable for cast iron. Running — Price $1,000.00 — Price w/o motor $700.00.
Milling Cutters with either. Will negotiate price.

Lees-Bradner Thread Mill.
LT-112. 50 hobs & supply of change gears. Excellent—Price $700.00.

Bullard Boring Mill (Maxi-Mill)
50" table—54" swing—44" max. dist. table to underside of rail—V belt dr.—on top. #11129. 4 face plate jaws. 20 HP—440/3 ph. motor. Running —Price $1,000.00.

24" Bullard-Spiral Dr. Vert. Turret Lathe.
15 HP, 3/60/220/440 AC Motor, 24" 3 jaw combination chuck. Turret and side head. Speeds to 190 RPM. Threading attachment—contour attachment. #23590. Good—Price $2,000.00.

36" Bullard—New Era.
20 HP—3/60/220/440 AC motor. V-Belt drive. Speeds to 140 RPM. 36"—3 jaw combination chuck. Turret and side head. Threading attachment. #10418. Good—Price $1,800.00.

Rogers B.T.L. #1500
30" dia.—4 jaw independent chuck. Pentagon Ram Turret. 7½ HP—3/60/440 A.C. Motor. V belt drive. Speeds 4.9 RPM to 91.8. Swing 37". Now in use—Condition Good.—Price $1,800.00.

All Machines F.O.B. East Jordan

EAST JORDAN IRON WORKS, INC.
East Jordan, Michigan
T. D. Malpass — Lenox 6-2261

CIRCLE 602 READER SERVICE CARD

Giant Horiz. BORING MILL
18" dia. Spindle, 13' Vert. & 30' Horiz. Travel
100 to 4000 T PRESSES
Unused and little used U. S. Govt. surplus machy. Mfgd. as late as 1955. Low price — Terms.

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1957A Clay, Detroit 11 TR 2-1270

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- Use this time-saving service to keep abreast of the latest in used, rebuilt, surplus new equipment, employment or business opportunities.

"MIDWESTERN" OFFERS "GUARANTEED" MACHINE TOOLS—

RBG = Rebuilt Condition Guaranteed
RCG = Reconditioned—Guaranteed
*Indicates 1940+ Model **Indicates 1950+

AUTOMATICS

#6 B&S 1 Spdl. 2" Cap. 7½ HP
*9/16"—6 spdl Acme RA6 w/Thrdg & Tooling
*1¼"—6 spdl Acme RA6 w/Thrdg & Tooling
*1½" Cleveland 1 Spdl Model B-18

BOREMATICS

**3U Stokerunit Dbl. End Dbl. Spdl. #DH-4 Heads
*2U Stokerunit Dbl. End Dbl. Spdl.
**221 & 321 Hould Sgl End, 2 Spdl Excellent.
*1212A Excello Dbl End, 4 Spdl 1948 RCG
**2U Simplex Dbl End Dbl Spdl Excel

BORING MILLS

*52" King VTL, Side Head
**54" G & L VBM Excel. Cond.
*5H Sellers 5" Horiz. Floor Type
**52" King VTL Side Head Clean
**54" G&L "Hypro", w/extra Heighth Excel.
*74" Bullard "Cutmaster" VTL Excel. Like Rblt.
*4 Sellers Horiz. Tbl. Type (1942)
*3" Universal Horiz. Tbl. Type (1941)
*3"—5H Sellers Floor Type—Nice Cond.

BROACH

**6 ton—54" Colonial Hydr Ser 15004, Excel.

CHUCKERS

**HC & HCT Hardinge Chuckers. 1950 & later

DRILLS

*1R Bakewell Radial Arm Drill 1HP
*21" Connady Otto #4 MT 19" Dia. Table
**22" Allan Box Col. 1 HP 0" Spdl. Feed
*25" No. 262 Barnes 4 MT. Air feed 3 HP
*28" Avey 2BMA6 w/Deep Hole Attch.
*28" Colburn No. 4 MT. 3" cap. 10 HP

DRILLS, MULTIPLE SPDL.

*3 Spdl. Lee-Giff on 5 Spdl. Base 3600 RPM 2 HP.
*4 Spdl. Lee-Giff #2 MT 3600 RPM 1 HP
**6 Spdl. Allan #2KH-24", ½ HP Mtrs.
**36 Spdl. C5B Natco 2½" U.J. 28 x 54 Head
**24 Spdl. C3B Natco 1½" U.J. 20 x 30 Head

DRILLS, RADIAL

4' x 11" Carleton, Tp'g P. Elev., Tbl.
**4' x 11" Amer. "Hole Wizard" RBG

GEAR MACHINERY

**#53-2 Vinco/Gear Checker Involuto
*#13 Gleason Hypoid Cutter Sharpner
**#600B Mich. Gear Finisher, Microflex Counter
**#106 Gleason Gear Generator s/n 32036
*#12 Gleason Generator Dbl. Roll R & Finisher
*19" Gleason Spir. Bev. Cutter Grinder
*#00 & #1 Hamilton Hobbers
*Type A Barber Coleman Hobbers (1 long bed)
**65A3 Fellows Shaper w/access.

GRINDERS, MISC.

**Wendt Sonic Eccnogrind #1A195
*4 x 12 Landis Ext. w/Plunge (2)
*8 x 18 Landis Ext. w/Plunge #24473
*12 x 36 Cinc. Univ. w/Int. Spdl. RBG
*16 x 36 Landis Cyl. w/5° Head
*18 x 16 Landis Cyl. Hydraulic
Wickman Microform (optical) Like New
**180 Sheffield, Multiform (1957) Like New
**1109 Bryant Internal 6" Str. 9. swing Excel
**1310R Bryant Hole Face & Int. 2S Spdl (1952)
**271 Heald "Sizematic" Internal RBG
*100 Bryant Int. New Spdl. (1947) RBG
**10x24 Cinc Univ. Plunge & Int Spdl (1953)
**10x24 No. 4BGi Van Norman 13" Head '56
**12x36 Landis Univ. Int Spdl (1950's)
**30x48 Landis CHW Univ Like New 1952
*#2 Cinc. Centerless, Profile Dresser RBG

GRINDERS, INT.

*72A3 Heald TR Mod. & Sizematic Mod.
*16-16 Bryant Chucking 1600 RPM
**#172 Heald 36" Swg. 36" Str. '43 & '50

GRINDERS, SURFACE

*12 x 36 Mattison, Hydr. Dresser
*12 x 36 G & L Hydr. Crush Grind Attch. 15 HP
*36" Hanchett #36 Rotary, 30 HP
*18"—#11 Blanchard Vert Rotary RBG
**#240—30" Bosley Dbl. Opposed, w/Ferris wheel

INSPECTION EQUIP.

K&E Trammel Insp Equip—⅓ Price—Like New

LAPPERS

*74A Excello Centerlap. 10 x 36, ½ HP
*26F Norton Hydr., Vert., 26" Cap. 10 HP

LATHES

**10 x 20 Monarch EE Mfg. Type 4000 RPM
*11 x 36 Logan w/collet attch. ½ HP
**15 x 54 LeBlond Dual Drive w/access.
*18 x 110 L & S w/TA. Chucks etc.
*22 x 126 L & S w/Chuck, SR etc.
*30 x 84 American 19" Air Chuck Coolnt.
*40 x 66" LeBlond H.D. Dual Contr. 40 HP
*42 x 33 ft. Wickes H.D., 2 Carriages
*30"x48"Monarch Mod CM, Ser. #16526
**16x54 Monarch Toolroom, H. ways, (1953)
*20x120 Springfield Tool'g, 10 HP RCG
*24x96 LeBlond H.D., Y. Att. Chuckh (1942)
*30x96 Niles "Timesaver" T.A. SJ, 4J RBG
*74" Star "T" Lathe. 15 HP Like New

LATHES, TURRET

**#2 B & O w#Barfeed. Collets etc.
**#4 Gisholt Univ. H Ways 2½" Cap
**#5 Gisholt Univ. H Ways 3" Hole
**3L Gisholt & Pressl w/CS Turret 1952
*2A W & S Saddle Type 3½" Cap B. Feed
**#3 Gisholt, Barfeed, 1952, Excel.
*#3 W&S w/Hydr. Barfeed & Tool'g RCG
*#4 W&S Preselector, Air Chucker (1942)
*#5 J&L Univ. w/Air chuck & Threadg. RCG
**#5 Gisholt Univ w/Chucking (1950's) RCG
*8B J&L Saddle Type 8" Bar Cap.
**3A W&S with Access. 1952 & 1948

LATHES, PRODUCTION

**Gisholt Simplomatic Autom 20", Rotation Table.
**17 x 76 Seneca Falls "Le Swing" 50 HP.

LATHES, TRACER

*30H Bullard 3 Spdl. Man-Au-Trol #28104
**60" Monarch "T" w/generator (1952)
**32x96 LeBlond Hydro Trace (1959)
*36"x30" Monarch H.D. w/Keller Tracer

MILLS

**1 HP Bridgeport Vert. w/P. Feed RCG
*2K K&T Horiz. Ser. RBG
**5H K&T Vert. Ser. RCG
*28-60 Cinc Vert Hydrotel 360° RCG
*4K—K&T Horiz., 18x42 Tbl. Trvl. 15 HP
**#4 Cinc H.S. D.T. Vert Mill (1951)
**V-20 Mammut (German) Vert. H.D. Univ.
**33—2448 Sundstrand Rigidmill 15 HP '52

"MIDWESTERN" MACHINERY COMPANY

2848 Pleasant TA 5-4461 Mpls 8, Minn.

CIRCLE 604 READER SERVICE CARD

FALK MACHINERY COMPANY

Every Item Guaranteed as Represented

Automatic: 2½", 8" CLEVE. MOD. "A".
Brake Press: 6' x ⅛" CINCINNATI, 8' Bed.
Broach: XL-12 Oil-Gear Horiz. Hyd. 6 Ton
Broach: XS-6-48 Oil-Gear Vert. Hyd.
Drill: 24" CINC-BICKFORD Super Service.
Drill: 2-spdl. No. 2LMS—26" LELAND-GIFF.
Drill: 6 spdl. No. 16—24" BUFFALO FORGE.
Drill: 3' x 9" CINC-BICKFORD Radial.
Drill: 5'x11" AMERICAN Radial Hole Wizard

14" x 16" x 60" MATTISON Hyd. Surf. Grinders. 1943. Mag. chuck, Barnes Mag. Separator.

Grinder: 6" x 18" G & L Hyd. Surface.
Grinder: 4"x12" LANDIS Type H Cyl. Hyd.
Jig Borer: No. 30A FOSDICK 44" x 22" Tbl.
Keyseaters: No. 5 DAVIS, MITTS & MERILL.

24", 36", 54" BULLARD Vert. Turret Lathes. Side Hd., Turret Hd., M.D., Spiral.

Lathes: No. 2, 3, 4, 5, 1A, 2A WARNER & SWASEY, Preselector, Bar Feed & Chucking.
Lathes: No. 3, 7 BARDONS & OLIVER Turret.
Lathe: 20" x 16' AMERICAN Grd. Hd. MD.
Lathe: 24" x 28' HENDEY Grd. Hd. MD.
Lathe: 42" x 42' NILES G.H. 32' Centers.
Lathe: 14" x 16' HENDEY Grd. Hd. Tool

No. 4 CINCINNATI Horiz. & #4 CINC. Vert. "DUAL POWER" Mills, 30 HP.

Mill: No. 24 KEARNEY & TRECKER Prod.
Mill: No. 2 BROWN & SHARPE Vert. M.D.
Mill: No. 3V VAN NORMAN Ram Type Vert.
Saw: 7" x 7" PEERLESS, Feed Table, 1951
Saw: No. 32C RACINE 10" x 16" Hyd.
24" Gould & Eberhardt, m.d.

BUY FROM STOCK — 316 ST. PAUL ST.
Telephone — ROCHESTER 5
BAKER 5-5887 — N. Y.

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Substantial and expanding British company engaged in the manufacture of metal products and having associate synthetic rubber producing plant seeks licensing agreements with correspondingly sound American concern for the manufacture of similar products for subsequent sale in European and Commonwealth markets.

BO-7258, AMERICAN MACHINIST
255 California St., San Francisco 11, Calif.

CIRCLE 610 READER SERVICE CARD

IMMEDIATE DELIVERY

2—#5 MINSTER HIGH SPEED O.B.I. BLANKING PRESSES, 45 ton, Flywheel type, 11" stroke, 5 HP Varidrives, Speed range 150-300 SPM. Equipped with #4-6 Perfecto Double Roll Feed and Scrap Cutter. Never used.
PRICE: F.O.B. East Boston.....$11,076.00 each

2—#6 MINSTER O.B.I. PRESSES, 60 ton Geared type, 7" stroke, 12" shutheight, 7½ HP Varidrives, 40-80 SPM. Never used.
PRICE F.O.B. East Boston.....$9500.00 each

WIGGLESWORTH MACHINERY COMPANY

60 Border St., East Boston, Mass.

CIRCLE 605 READER SERVICE CARD

FOR SALE BY ORIGINAL OWNER

Nineteen, Model A-25 Traub Automatic Screw Machines. Collet capacity 1". Spindle speeds 550 to 4000 rpm. Longitudinal turning length 3¼". 2 hp, 220 v., 3-phase. Bar stock feed, machine light. Average age, 5 years. Condition excellent. $1400 each at our plant.

One, Cincinnati Hydromatic Production Mill No. 324, (1940). Condition good. $2425 at our plant.

One, Cincinnati Hydromatic Traced Controlled Milling Machine, Model No. 34-36, (1941). Condition good. $2275 at our plant.

Direct inquiries to Purchasing Department

OMARK INDUSTRIES, INC.

9701 S.E. McLoughlin Bl'd., Portl'd. 22, Ore.
PR 5-4211

CIRCLE 607 READER SERVICE CARD

WANTED

Two Roll Medart or equivalent Rod Straightener
¼" to ¾" capacity.
Must be excellent.

W-7220, AMERICAN MACHINIST
Class. Adv. Div., P.O. Box 12, N.Y. 36, N.Y.

CIRCLE 611 READER SERVICE CARD

BRAKES PRESSES SHEARS

Will Lease or Furnish Long Terms

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2600 E. Tioga St., Philadelphia 34, Pa.

CIRCLE 606 READER SERVICE CARD

OVER 300

Late Type
MACHINE TOOLS
and
FABRICATING EQUIPMENT
— Send Us Your Inquiries —

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1036 W. Lake St., Chicago, Ill. TAylor 8-3553

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For just $3.00 you get ANSWERS!

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Order yours today

WALLACE SUPPLIES MFG. CO.

3510 N. Ravenswood Ave. Chicago 13, Illinois

CIRCLE 615 ON READER SERVICE CARD

WANTED CAPABLE MACHINIST

For accurate work on large machine tools in Texas. Must have crankshaft finishing experience, good health, good habits. Age not an issue. Steady work, pleasant working conditions, good pay for right man.

P-7125, AMERICAN MACHINIST
645 N. Michigan Ave., Chicago 11, Ill.

CIRCLE 612 READER SERVICE CARD

CIRCLE 613 READER SERVICE CARD ▶

AVAILABLE NOW!

AUTOMATICS:
B & S OOG Double Chain St., V. St.
Brown & Sharpe #OG, 10,000 Ser. (2)
New Britain #126 2⅝" Sgl. Spdl., 1951

BROACHING MACHINES:
Lapointe SRV 3-Ton 48" Vertical, 1957
Lapointe 4L Horiz. Hyd. 20 Ton, 1953

CHUCKING MACHINES:
Potter & Johnston 3U, 1950
Potter & Johnston 6DE, 1951

DRILLS:
Natco Model A33 1953

RADIAL DRILLS:
Cincinnati-Bickford 3'9" Super Service
Cincinnati-Bickford 4'11" Super Service
Morris 5'11" Mor-Speed, Bullard 20" x 30" Spacer Table, 1951
Morris 4'13" Column, Mor-Speed

DIE SINKERS:
Pratt & Whitney Model 3B Plain
Pratt & Whitney 3B Universal

GEAR EQUIPMENT:
Fellows 3" Fine Pitch Shaper, 1957
Fellows 4" Fine Pitch Shaver, 1953

INTERNAL GRINDERS:
Bryant #16-38 Chucking

SURFACE GRINDERS:
Blanchard #11-16" Rotary
Heald 25A-25" Rotary
Taft-Peirce-6" Rotary

MISCELLANEOUS GRINDERS:
Ingersoll 30" Face Mill (2)
Pratt & Whitney 16" x 24" Vert. Die, Never Used

JIG BORERS:
Pratt & Whitney #1-1/2B, 1952
Pratt & Whitney #3B, 1952
Pratt & Whitney #2A, 1953
Pratt & Whitney #2A, 16" x 36"

KELLERING MACHINES:
Pratt & Whitney BG1, 3' x 5', 1948
Pratt & Whitney BG1, 3' x 10', 1949
Pratt & Whitney BG2, 5' x 10', 1942
Pratt & Whitney BL3620, 3 Spindle

ENGINE LATHES:
Monarch 12" x 30", Model CK
Monarch 14" x 30", Keller Attachment
Monarch 16" x 54", Model CU
Monarch 16" x 30", Model CU
Monarch 16" x 78", Mod. CW, Keller Attachment
Monarch 20" x 48", Model CU
Pratt & Whitney, 16" x 30", Model C
Pratt & Whitney, 16" x 78", Model C

TURRET LATHES:
Gisholt 3, 4, 5, Ram Type
Jones & Lamson #5 Ram Type
Jones & Lamson 6A Saddle Type
Warner & Swasey 3, 4, 5 Ram Type

MILLING MACHINES:
K & T 3H Vert. Auto. Cycl. 1948
Cinn. #4 H.S.D.T. Vert. 1952

PLANERS:
Rockford 36" x 36" x 18' Openside, 1957
Gray, 30" x 30" x 8', 3 Heads, 1945
Rockford 56" x 56" x 20' Double Housing 1954

PROFILERS:
Pratt & Whitney 30" Single Spdl., 1953

SHEARS:
Niagara 54B, 4' x 10 Ga., 1951
Niagara #68, 8' x 10 Ga.

PRESSES:
Bliss #28-95-Ton OBI 1945
Bliss 6½-72W 165-Ton S.S.D.C. 1947
Dennison 4 & 8 Ton, C Frame Hyd.
Clearing Series F 100-Ton S.S. Air Clutch
Minster No. 9 113-ton OBI, Air Clutch

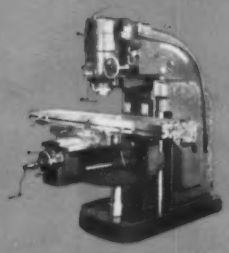
ROTARY TABLES:
Pratt & Whitney 42" Vert. Automatic (Never Used)
Pratt & Whitney 12" Plain, M.D.

PARTIAL LISTING OF OUR STOCK

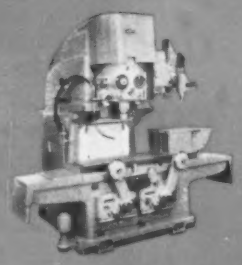
MACHINERY TRADING CORPORATION *Modern Trading Concept* **Has Enabled Us to "Trade-In" The Machines Featured Below. The Difference In Type of Machine and Selectivity of Age Shows the Unusual Inventory We Have. Listed at Left Are Some of The Other Machines in Stock.**

Check Your Requirements Against These Machines. Perhaps We Do Not List the Exact Machine You Require—Space Limitations Prevent Us From Listing All Our Inventory. Contact Us Regarding Your Exact Requirements. If We Do Not Have It in Stock, Possibly We Are At Present Negotiating A Trade For the Very Machine You Require.

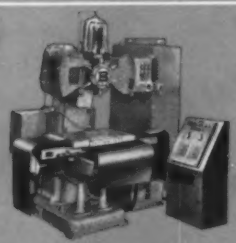
Send Us Your Inquiries.



#4 Cincinnati High Speed Dial Type Vertical Mill. New 1952, Serial 4A4V1Y-30. Power Feed to Head, 1300 RPM.



Cincinnati 16" Series Vertical Hydrotel Millers Serials #3H1V1W-44 and #3H1V5B-4; New 1950 and 1953; Complete With Depth Control and All Standard Accessories.



Burgmaster Model 20HT Tape Controlled Turret Drill. Serial #20648, New 1959, 15" x 20" Positioning Table, Electro-Point 2-Dimensional Tape Controlled Unit. 220/3/60 Electrics. Condition Like New.

Thompson Type BB 12" x 10" x 24" Heavy Duty Surface Grinder. Serial 524544, New 1952, Power Down Feed, 7½ HP Spindles, 20" Diameter Wheels, Coolant System.

Heald No. 322 Double End Borematic, Serial #31245 with 220/440/3/60 Electrics; Standard Specifications; New 1951.

Thompson 6" x 18" Type F Hydraulic Surface Grinder. Serial #531700. New 1953 With Chuck, Coolant thru Spindle; Hoaglund KB4, Contour Dresser and Hoaglund Diamond Setting Telescope.

SEE PRATT & WHITNEY MESSAGE ON PAGE 67

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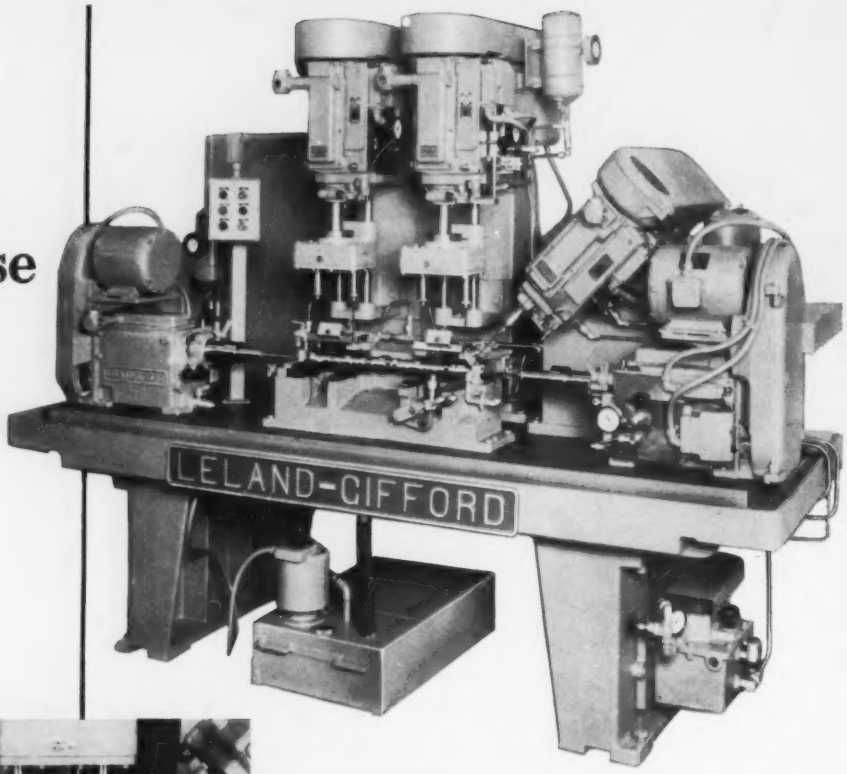
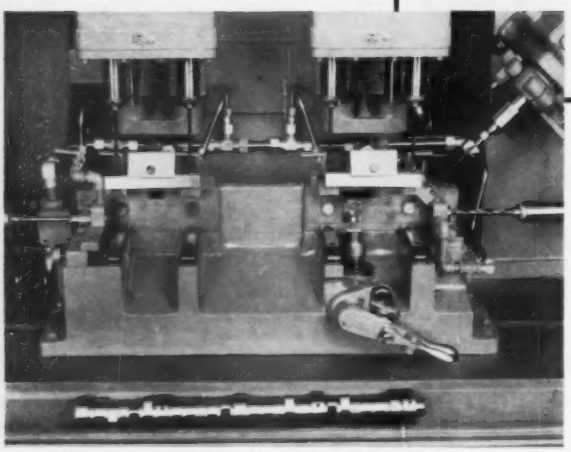
Here's an idea you can use to cut precision drilling costs . . . .





One machine, one handling, one quick, simple operation does all the precision drilling on this camshaft. Note that this is not ordinary gang drilling — the job involves axial, angular and cross holes as well as reaming.

Leland-Gifford has time-saving, cost-cutting ideas for you, too — ways you can combine multiple operations into a simple, efficient unit operation.

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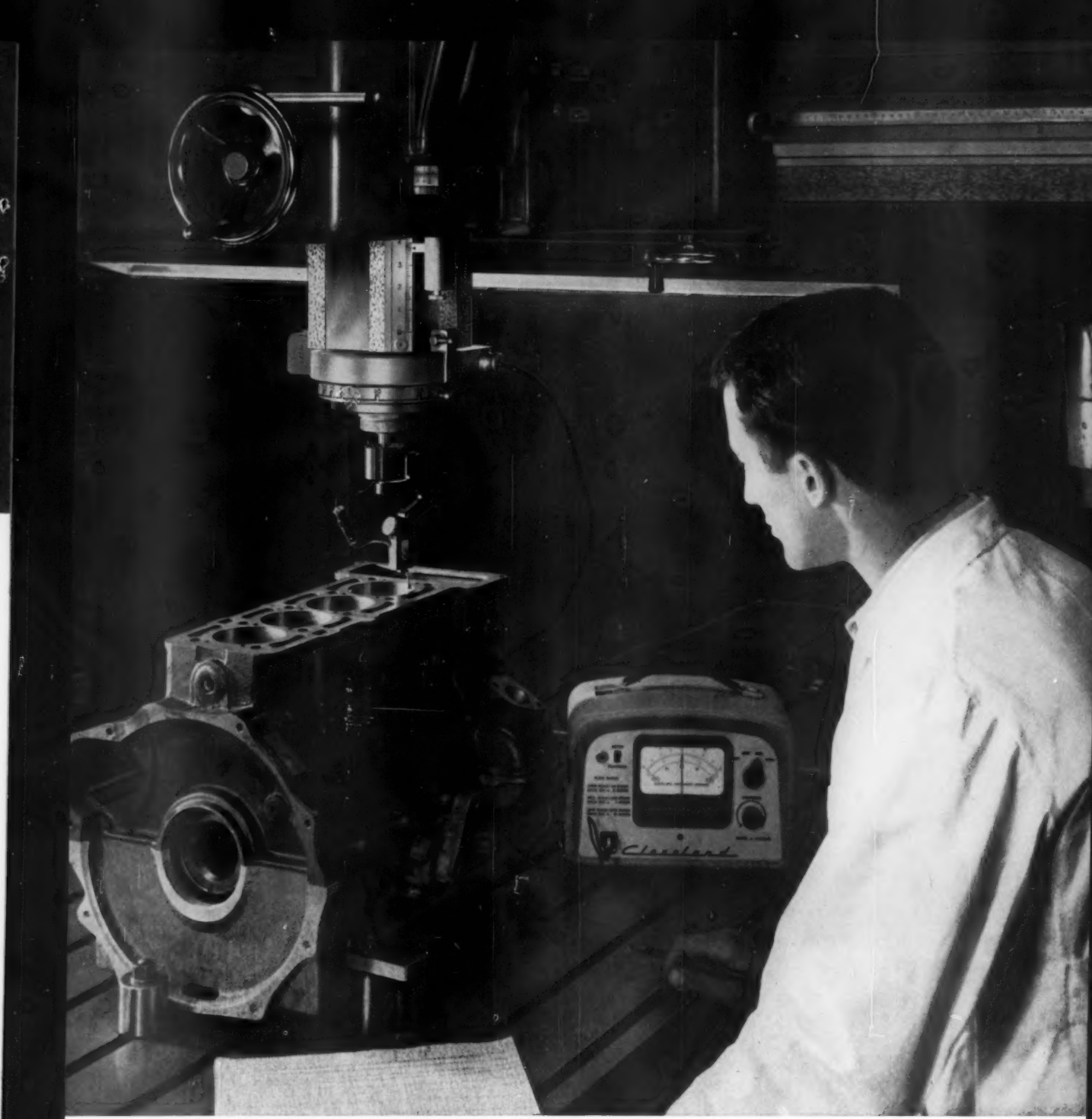

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